

RapidIO Subsystem Guide

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by Matt Porter

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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

Bugs

None. ;)

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.

Functions

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

<i>port</i>	Master port
<i>offset</i>	Offset into local configuration space
<i>data</i>	Pointer to read data into

Description

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

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

<i>port</i>	Master port
<i>offset</i>	Offset into local configuration space
<i>data</i>	Data to be written

Description

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

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

<i>port</i>	Master port
<i>offset</i>	Offset into local configuration space
<i>data</i>	Pointer to read data into

Description

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

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

<i>port</i>	Master port
<i>offset</i>	Offset into local configuration space
<i>data</i>	Data to be written

Description

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

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

<i>port</i>	Master port
<i>offset</i>	Offset into local configuration space
<i>data</i>	Pointer to read data into

Description

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

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.

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

<i>rdev</i>	RIO device
<i>offset</i>	Offset into device configuration space
<i>data</i>	Pointer to read data into

Description

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

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.

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

<i>rdev</i>	RIO device
<i>offset</i>	Offset into device configuration space
<i>data</i>	Pointer to read data into

Description

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

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.

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

<i>rdev</i>	RIO device
<i>offset</i>	Offset into device configuration space
<i>data</i>	Pointer to read data into

Description

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

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.

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.

Name

`rio_init_mbox_res` — Initialize a RIO mailbox resource

Synopsis

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

Arguments

<i>res</i>	resource struct
<i>start</i>	start of mailbox range
<i>end</i>	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.

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.

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`.

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

<i>mport</i>	RIO master port containing the outbound queue
<i>rdev</i>	RIO device the message is be sent to
<i>mbox</i>	The outbound mailbox queue
<i>buffer</i>	Pointer to the message buffer
<i>len</i>	Length of the message buffer

Description

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

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.

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.

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.

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.

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.

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.

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.

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.

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`.

Name

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

Synopsis

```
u16 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.

Name

`rio_query_mport` — Query mport device attributes

Synopsis

```
int rio_query_mport (struct rio_mport * port, struct rio_mport_attr *  
mport_attr);
```

Arguments

port mport device to query

mport_attr mport attributes data structure

Description

Returns attributes of specified mport through the pointer to attributes data structure.

Name

`rio_alloc_net` — Allocate and initialize a new RIO network data structure

Synopsis

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

Arguments

mport 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.

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.

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.

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.

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.

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.

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.

Name

`rio_request_inb_dbell` — request inbound doorbell message service

Synopsis

```
int rio_request_inb_dbell (struct rio_mport * mport, void * dev_id, u16
start, u16 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.

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.

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.

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.

Name

`rio_add_mport_pw_handler` — add port-write message handler into the list of mport specific pw handlers

Synopsis

```
int rio_add_mport_pw_handler (struct rio_mport * mport, void * context,  
int (*pwcallback) (struct rio_mport *mport, void *context, union rio_pw_msg  
*msg, int step));
```

Arguments

mport RIO master port to bind the portwrite callback

context Handler specific context to pass on event

pwcallback Callback to execute when portwrite is received

Description

Returns 0 if the request has been satisfied.

Name

`rio_del_mport_pw_handler` — remove port-write message handler from the list of mport specific pw handlers

Synopsis

```
int rio_del_mport_pw_handler (struct rio_mport * mport, void * context,  
int (*pwcallback) (struct rio_mport *mport, void *context, union rio_pw_msg  
*msg, int step));
```

Arguments

mport RIO master port to bind the portwrite callback

context Registered handler specific context to pass on event

pwcallback Registered callback function

Description

Returns 0 if the request has been satisfied.

Name

`rio_request_inb_pwrite` — request inbound port-write message service for specific RapidIO device

Synopsis

```
int rio_request_inb_pwrite (struct rio_dev * rdev, int (*pwcallback)
(struct rio_dev *rdev, union rio_pw_msg *msg, int step));
```

Arguments

rdev RIO device to which register inbound port-write callback routine

pwcallback Callback routine to execute when port-write is received

Description

Binds a port-write callback function to the RapidIO device. Returns 0 if the request has been satisfied.

Name

`rio_release_inb_pwrite` — release inbound port-write message service associated with specific RapidIO device

Synopsis

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

Arguments

rdev RIO device which registered for inbound port-write callback

Description

Removes callback from the `rio_dev` structure. Returns 0 if the request has been satisfied.

Name

`rio_pw_enable` — Enables/disables port-write handling by a master port

Synopsis

```
void rio_pw_enable (struct rio_mport * mport, int enable);
```

Arguments

mport Master port associated with port-write handling

enable 1=enable, 0=disable

Name

`rio_map_inb_region` — - Map inbound memory region.

Synopsis

```
int rio_map_inb_region (struct rio_mport * mport, dma_addr_t local, u64  
rbase, u32 size, u32 rflags);
```

Arguments

<i>mport</i>	Master port.
<i>local</i>	physical address of memory region to be mapped
<i>rbase</i>	RIO base address assigned to this window
<i>size</i>	Size of the memory region
<i>rflags</i>	Flags for mapping.

Return

0 -- Success.

This function will create the mapping from RIO space to local memory.

Name

`rio_unmap_inb_region` — - Unmap the inbound memory region

Synopsis

```
void rio_unmap_inb_region (struct rio_mport * mport, dma_addr_t lstart);
```

Arguments

mport Master port

lstart physical address of memory region to be unmapped

Name

`rio_map_outb_region` — - Map outbound memory region.

Synopsis

```
int rio_map_outb_region (struct rio_mport * mport, u16 destid, u64  
rbase, u32 size, u32 rflags, dma_addr_t * local);
```

Arguments

mport Master port.

destid destination id window points to

rbase RIO base address window translates to

size Size of the memory region

rflags Flags for mapping.

local physical address of memory region mapped

Return

0 -- Success.

This function will create the mapping from RIO space to local memory.

Name

`rio_unmap_outb_region` — - Unmap the inbound memory region

Synopsis

```
void rio_unmap_outb_region (struct rio_mport * mport, u16 destid, u64  
rstart);
```

Arguments

mport Master port

destid destination id mapping points to

rstart RIO base address window translates to

Name

`rio_mport_get_physefb` — Helper function that returns register offset for Physical Layer Extended Features Block.

Synopsis

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

Arguments

<i>port</i>	Master port to issue transaction
<i>local</i>	Indicate a local master port or remote device access
<i>destid</i>	Destination ID of the device
<i>hopcount</i>	Number of switch hops to the device
<i>rmap</i>	pointer to location to store register map type info

Name

`rio_get_comptag` — Begin or continue searching for a RIO device by component tag

Synopsis

```
struct rio_dev * rio_get_comptag (u32 comp_tag, struct rio_dev * from);
```

Arguments

comp_tag RIO component tag to match

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 *comp_tag*, 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.

Name

`rio_set_port_lockout` — Sets/clears LOCKOUT bit (RIO EM 1.3) for a switch port.

Synopsis

```
int rio_set_port_lockout (struct rio_dev * rdev, u32 pnum, int lock);
```

Arguments

rdev Pointer to RIO device control structure

pnum Switch port number to set LOCKOUT bit

lock Operation : set (=1) or clear (=0)

Name

`rio_enable_rx_tx_port` — enable input receiver and output transmitter of given port

Synopsis

```
int rio_enable_rx_tx_port (struct rio_mport * port, int local, u16  
destid, u8 hopcount, u8 port_num);
```

Arguments

<i>port</i>	Master port associated with the RIO network
<i>local</i>	<code>local=1</code> select local port otherwise a far device is reached
<i>destid</i>	Destination ID of the device to check host bit
<i>hopcount</i>	Number of hops to reach the target
<i>port_num</i>	Port (-number on switch) to enable on a far end device

Description

Returns 0 or 1 from on General Control Command and Status Register (EXT_PTR+0x3C)

Name

`rio_mport_chk_dev_access` — Validate access to the specified device.

Synopsis

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

Arguments

<i>mport</i>	Master port to send transactions
<i>destid</i>	Device destination ID in network
<i>hopcount</i>	Number of hops into the network

Name

`rio_inb_pwrite_handler` — inbound port-write message handler

Synopsis

```
int rio_inb_pwrite_handler (struct rio_mport * mport, union rio_pw_msg  
* pw_msg);
```

Arguments

mport mport device associated with port-write

pw_msg pointer to inbound port-write message

Description

Processes an inbound port-write message. Returns 0 if the request has been satisfied.

Name

`rio_mport_get_efb` — get pointer to next extended features block

Synopsis

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

Arguments

<i>port</i>	Master port to issue transaction
<i>local</i>	Indicate a local master port or remote device access
<i>destid</i>	Destination ID of the device
<i>hopcount</i>	Number of switch hops to the device
<i>from</i>	Offset of current Extended Feature block header (if 0 starts from ExtFeaturePtr)

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

<i>port</i>	Master port to issue transaction
<i>local</i>	Indicate a local master port or remote device access
<i>destid</i>	Destination ID of the device
<i>hopcount</i>	Number of switch hops to the device
<i>ftr</i>	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.

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

Arguments

<i>vid</i>	RIO vid to match or <code>RIO_ANY_ID</code> to match all vids
<i>did</i>	RIO did to match or <code>RIO_ANY_ID</code> to match all dids
<i>asm_vid</i>	RIO <code>asm_vid</code> to match or <code>RIO_ANY_ID</code> to match all <code>asm_vids</code>
<i>asm_did</i>	RIO <code>asm_did</code> to match or <code>RIO_ANY_ID</code> to match all <code>asm_dids</code>
<i>from</i>	Previous RIO device found in search, or <code>NULL</code> 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`.

Name

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

Synopsis

```
struct rio_dev * rio_get_device (ul6 vid, ul6 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`.

Name

`rio_lock_device` — Acquires host device lock for specified device

Synopsis

```
int rio_lock_device (struct rio_mport * port, u16 destid, u8 hopcount,  
int wait_ms);
```

Arguments

<i>port</i>	Master port to send transaction
<i>destid</i>	Destination ID for device/switch
<i>hopcount</i>	Hopcount to reach switch
<i>wait_ms</i>	Max wait time in msec (0 = no timeout)

Description

Attempts to acquire host device lock for specified device Returns 0 if device lock acquired or EINVAL if timeout expires.

Name

`rio_unlock_device` — Releases host device lock for specified device

Synopsis

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

Arguments

<i>port</i>	Master port to send transaction
<i>destid</i>	Destination ID for device/switch
<i>hopcount</i>	Hopcount to reach switch

Description

Returns 0 if device lock released or EINVAL if fails.

Name

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

Synopsis

```
int rio_route_add_entry (struct rio_dev * rdev, u16 table, u16 route_destid, u8 route_port, int lock);
```

Arguments

<i>rdev</i>	RIO device
<i>table</i>	Routing table ID
<i>route_destid</i>	Destination ID to be routed
<i>route_port</i>	Port number to be routed
<i>lock</i>	apply a hardware lock on switch device flag (1=lock, 0=no_lock)

Description

If available calls the switch specific `add_entry` method to add a route entry into a switch routing table. Otherwise uses standard RT update method as defined by RapidIO specification. A specific routing table can be selected using the *table* argument if a switch has per port routing tables or the standard (or global) table may be used by passing `RIO_GLOBAL_TABLE` in *table*.

Returns 0 on success or `-EINVAL` on failure.

Name

`rio_route_get_entry` — Read an entry from a switch routing table

Synopsis

```
int rio_route_get_entry (struct rio_dev * rdev, u16 table, u16 route_destid, u8 * route_port, int lock);
```

Arguments

<i>rdev</i>	RIO device
<i>table</i>	Routing table ID
<i>route_destid</i>	Destination ID to be routed
<i>route_port</i>	Pointer to read port number into
<i>lock</i>	apply a hardware lock on switch device flag (1=lock, 0=no_lock)

Description

If available calls the switch specific `get_entry` method to fetch a route entry from a switch routing table. Otherwise uses standard RT read method as defined by RapidIO specification. A specific routing table can be selected using the *table* argument if a switch has per port routing tables or the standard (or global) table may be used by passing `RIO_GLOBAL_TABLE` in *table*.

Returns 0 on success or `-EINVAL` on failure.

Name

`rio_route_clr_table` — Clear a switch routing table

Synopsis

```
int rio_route_clr_table (struct rio_dev * rdev, u16 table, int lock);
```

Arguments

rdev RIO device

table Routing table ID

lock apply a hardware lock on switch device flag (1=lock, 0=no_lock)

Description

If available calls the switch specific `clr_table` method to clear a switch routing table. Otherwise uses standard RT write method as defined by RapidIO specification. A specific routing table can be selected using the *table* argument if a switch has per port routing tables or the standard (or global) table may be used by passing `RIO_GLOBAL_TABLE` in *table*.

Returns 0 on success or `-EINVAL` on failure.

Name

`rio_request_mport_dma` — request RapidIO capable DMA channel associated with specified local RapidIO mport device.

Synopsis

```
struct dma_chan * rio_request_mport_dma (struct rio_mport * mport);
```

Arguments

mport RIO mport to perform DMA data transfers

Description

Returns pointer to allocated DMA channel or NULL if failed.

Name

`rio_request_dma` — request RapidIO capable DMA channel that supports specified target RapidIO device.

Synopsis

```
struct dma_chan * rio_request_dma (struct rio_dev * rdev);
```

Arguments

rdev RIO device associated with DMA transfer

Description

Returns pointer to allocated DMA channel or NULL if failed.

Name

`rio_release_dma` — release specified DMA channel

Synopsis

```
void rio_release_dma (struct dma_chan * dchan);
```

Arguments

dchan DMA channel to release

Name

`rio_dma_prep_xfer` — RapidIO specific wrapper for `device_prep_slave_sg` callback defined by DMAENGINE.

Synopsis

```
struct dma_async_tx_descriptor * rio_dma_prep_xfer (struct dma_chan *  
dchan, u16 destid, struct rio_dma_data * data, enum dma_transfer_direc-  
tion direction, unsigned long flags);
```

Arguments

<i>dchan</i>	DMA channel to configure
<i>destid</i>	target RapidIO device destination ID
<i>data</i>	RIO specific data descriptor
<i>direction</i>	DMA data transfer direction (TO or FROM the device)
<i>flags</i>	dmaengine defined flags

Description

Initializes RapidIO capable DMA channel for the specified data transfer. Uses DMA channel private extension to pass information related to remote target RIO device.

Return

pointer to DMA transaction descriptor if successful, error-valued pointer or NULL if failed.

Name

`rio_dma_prep_slave_sg` — RapidIO specific wrapper for `device_prep_slave_sg` callback defined by DMAENGINE.

Synopsis

```
struct dma_async_tx_descriptor * rio_dma_prep_slave_sg (struct rio_dev
* rdev, struct dma_chan * dchan, struct rio_dma_data * data, enum
dma_transfer_direction direction, unsigned long flags);
```

Arguments

<i>rdev</i>	RIO device control structure
<i>dchan</i>	DMA channel to configure
<i>data</i>	RIO specific data descriptor
<i>direction</i>	DMA data transfer direction (TO or FROM the device)
<i>flags</i>	dmaengine defined flags

Description

Initializes RapidIO capable DMA channel for the specified data transfer. Uses DMA channel private extension to pass information related to remote target RIO device.

Return

pointer to DMA transaction descriptor if successful, error-valued pointer or NULL if failed.

Name

`rio_register_scan` — enumeration/discovery method registration interface

Synopsis

```
int rio_register_scan (int mport_id, struct rio_scan * scan_ops);
```

Arguments

mport_id mport device ID for which fabric scan routine has to be set (RIO_MPORT_ANY = set for all available mports)

scan_ops enumeration/discovery operations structure

Description

Registers enumeration/discovery operations with RapidIO subsystem and attaches it to the specified mport device (or all available mports if RIO_MPORT_ANY is specified).

Returns error if the mport already has an enumerator attached to it. In case of RIO_MPORT_ANY skips mports with valid scan routines (no error).

Name

`rio_unregister_scan` — removes enumeration/discovery method from mport

Synopsis

```
int rio_unregister_scan (int mport_id, struct rio_scan * scan_ops);
```

Arguments

mport_id mport device ID for which fabric scan routine has to be unregistered (RIO_MPORT_ANY = apply to all mports that use the specified scan_ops)

scan_ops enumeration/discovery operations structure

Description

Removes enumeration or discovery method assigned to the specified mport device. If RIO_MPORT_ANY is specified, removes the specified operations from all mports that have them attached.

Chapter 4. Internals

This chapter contains the autogenerated documentation of the RapidIO subsystem.

Structures

Name

struct rio_switch — RIO switch info

Synopsis

```
struct rio_switch {  
    struct list_head node;  
    u8 * route_table;  
    u32 port_ok;  
    struct rio_switch_ops * ops;  
    spinlock_t lock;  
    struct rio_dev * nextdev[0];  
};
```

Members

node	Node in global list of switches
route_table	Copy of switch routing table
port_ok	Status of each port (one bit per port) - OK=1 or UNINIT=0
ops	pointer to switch-specific operations
lock	lock to serialize operations updates
nextdev[0]	Array of per-port pointers to the next attached device

Name

struct rio_switch_ops — Per-switch operations

Synopsis

```
struct rio_switch_ops {
    struct module * owner;
    int (* add_entry) (struct rio_mport *mport, u16 destid, u8 hopcount, u16 table, u8 sw_domain);
    int (* get_entry) (struct rio_mport *mport, u16 destid, u8 hopcount, u16 table, u8 sw_domain);
    int (* clr_table) (struct rio_mport *mport, u16 destid, u8 hopcount, u16 table);
    int (* set_domain) (struct rio_mport *mport, u16 destid, u8 hopcount, u8 sw_domain);
    int (* get_domain) (struct rio_mport *mport, u16 destid, u8 hopcount, u8 *sw_domain);
    int (* em_init) (struct rio_dev *dev);
    int (* em_handle) (struct rio_dev *dev, u8 swport);
};
```

Members

owner	The module owner of this structure
add_entry	Callback for switch-specific route add function
get_entry	Callback for switch-specific route get function
clr_table	Callback for switch-specific clear route table function
set_domain	Callback for switch-specific domain setting function
get_domain	Callback for switch-specific domain get function
em_init	Callback for switch-specific error management init function
em_handle	Callback for switch-specific error management handler function

Description

Defines the operations that are necessary to initialize/control a particular RIO switch device.

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;
    bool do_enum;
    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;
    u32 comp_tag;
    u32 phys_efptr;
    u32 phys_rmap;
    u32 em_efptr;
    u64 dma_mask;
    struct rio_driver * driver;
    struct device dev;
    struct resource riores[RIO_MAX_DEV_RESOURCES];
    int (* pwcback) (struct rio_dev *rdev, union rio_pw_msg *msg, int step);
    u16 destid;
    u8 hopcount;
    struct rio_dev * prev;
    atomic_t state;
    struct rio_switch rswitch[0];
};
```

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
do_enum	Enumeration flag
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
comp_tag	RIO component tag
phys_efptr	RIO device extended features pointer
phys_rmap	LP-Serial Register Map Type (1 or 2)
em_efptr	RIO Error Management features pointer
dma_mask	Mask of bits of RIO address this device implements
driver	Driver claiming this device
dev	Device model device
riores[RIO_MAX_DE- V_RESOURCES]	RIO resources this device owns
pwcbck	port-write callback function for this device
destid	Network destination ID (or associated destid for switch)
hopcount	Hopcount to this device
prev	Previous RIO device connected to the current one
state	device state
rswitch[0]	struct rio_switch (if valid for this device)

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 slot);  
};
```

Members

res	Mailbox resource
mcback	Message event callback

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, u16 info,  
    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

Name

struct rio_mport — RIO master port info

Synopsis

```
struct rio_mport {
    struct list_head dbells;
    struct list_head pwrites;
    struct list_head node;
    struct list_head nnode;
    struct rio_net * net;
    struct mutex lock;
    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;
    u32 phys_efptr;
    u32 phys_rmap;
    unsigned char name[RIO_MAX_MPORT_NAME];
    struct device dev;
    void * priv;
#ifdef CONFIG_RAPIDIO_DMA_ENGINE
    struct dma_device dma;
#endif
    struct rio_scan * nscan;
    atomic_t state;
    unsigned int pwe_refcnt;
};
```

Members

dbells	List of doorbell events
pwrites	List of portwrite events
node	Node in global list of master ports
nnode	Node in network list of master ports
net	RIO net this mport is attached to
lock	lock to synchronize lists manipulations
iores	I/O mem resource that this master port interface owns
riores[RIO_MAX_M- PORT_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
phys_efptr	RIO port extended features pointer
phys_rmap	LP-Serial EFB Register Mapping type (1 or 2).
name[RIO_MAX_M- PORT_NAME]	Port name string
dev	device structure associated with an mport
priv	Master port private data
dma	DMA device associated with mport
nscan	RapidIO network enumeration/discovery operations
state	mport device state
pwe_refcnt	port-write enable ref counter to track enable/disable requests

Name

struct rio_net — RIO network info

Synopsis

```
struct rio_net {
    struct list_head node;
    struct list_head devices;
    struct list_head switches;
    struct list_head mports;
    struct rio_mport * hport;
    unsigned char id;
    struct device dev;
    void * enum_data;
    void (* release) (struct rio_net *net);
};
```

Members

node	Node in global list of RIO networks
devices	List of devices in this network
switches	List of switches in this network
mports	List of master ports accessing this network
hport	Default port for accessing this network
id	RIO network ID
dev	Device object
enum_data	private data specific to a network enumerator
release	enumerator-specific release callback

Name

struct rio_mport_attr — RIO mport device attributes

Synopsis

```
struct rio_mport_attr {  
    int flags;  
    int link_speed;  
    int link_width;  
    int dma_max_sge;  
    int dma_max_size;  
    int dma_align;  
};
```

Members

flags	mport device capability flags
link_speed	SRIO link speed value (as defined by RapidIO specification)
link_width	SRIO link width value (as defined by RapidIO specification)
dma_max_sge	number of SG list entries that can be handled by DMA channel(s)
dma_max_size	max number of bytes in single DMA transfer (SG entry)
dma_align	alignment shift for DMA operations (as for other DMA operations)

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, u32 *data);
    int (* lcwrite) (struct rio_mport *mport, int index, u32 offset, int len, u32 data);
    int (* cread) (struct rio_mport *mport, int index, u16 destid, u8 hopcount, u32 *data);
    int (* cwrite) (struct rio_mport *mport, int index, u16 destid, u8 hopcount, u32 data);
    int (* dsend) (struct rio_mport *mport, int index, u16 destid, u16 data);
    int (* pwenable) (struct rio_mport *mport, int enable);
    int (* open_outb_mbox) (struct rio_mport *mport, void *dev_id, int mbox, int entries);
    void (* close_outb_mbox) (struct rio_mport *mport, int mbox);
    int (* open_inb_mbox) (struct rio_mport *mport, void *dev_id, int mbox, int entries);
    void (* close_inb_mbox) (struct rio_mport *mport, int mbox);
    int (* add_outb_message) (struct rio_mport *mport, struct rio_dev *rdev, int mbox, void *buf);
    int (* add_inb_buffer) (struct rio_mport *mport, int mbox, void *buf);
    void (* get_inb_message) (struct rio_mport *mport, int mbox, void *buf);
    int (* map_inb) (struct rio_mport *mport, dma_addr_t lstart, u64 rstart, u64 size);
    void (* unmap_inb) (struct rio_mport *mport, dma_addr_t lstart);
    int (* query_mport) (struct rio_mport *mport, struct rio_mport_attr *attr);
    int (* map_outb) (struct rio_mport *mport, u16 destid, u64 rstart, u32 size, u32 *data);
    void (* unmap_outb) (struct rio_mport *mport, u16 destid, u64 rstart);
};
```

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.
pwenable	Callback to enable/disable port-write message handling.
open_outb_mbox	Callback to initialize outbound mailbox.
close_outb_mbox	Callback to shut down outbound mailbox.
open_inb_mbox	Callback to initialize inbound mailbox.
close_inb_mbox	Callback to shut down inbound mailbox.
add_outb_message	Callback to add a message to an outbound mailbox queue.
add_inb_buffer	Callback to add a buffer to an inbound mailbox queue.
get_inb_message	Callback to get a message from an inbound mailbox queue.
map_inb	Callback to map RapidIO address region into local memory space.

<code>unmap_inb</code>	Callback to unmap RapidIO address region mapped with <code>map_inb</code> .
<code>query_mport</code>	Callback to query mport device attributes.
<code>map_outb</code>	Callback to map outbound address region into local memory space.
<code>unmap_outb</code>	Callback to unmap outbound RapidIO address region.

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);
    void (* shutdown) (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
shutdown	shutdown notification callback
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.

Name

struct rio_scan — RIO enumeration and discovery operations

Synopsis

```
struct rio_scan {  
    struct module * owner;  
    int (* enumerate) (struct rio_mport *mport, u32 flags);  
    int (* discover) (struct rio_mport *mport, u32 flags);  
};
```

Members

owner	The module owner of this structure
enumerate	Callback to perform RapidIO fabric enumeration.
discover	Callback to perform RapidIO fabric discovery.

Name

struct rio_scan_node — list node to register RapidIO enumeration and discovery methods with RapidIO core.

Synopsis

```
struct rio_scan_node {  
    int mport_id;  
    struct list_head node;  
    struct rio_scan * ops;  
};
```

Members

mport_id	ID of an mport (net) serviced by this enumerator
node	node in global list of registered enumerators
ops	RIO enumeration and discovery operations

Enumeration and Discovery

Name

`rio_destid_alloc` — Allocate next available destID for given network

Synopsis

```
ul6 rio_destid_alloc (struct rio_net * net);
```

Arguments

net RIO network

Description

Returns next available device destination ID for the specified RIO network. Marks allocated ID as one in use. Returns `RIO_INVALID_DESTID` if new destID is not available.

Name

`rio_destid_reserve` — Reserve the specivied destID

Synopsis

```
int rio_destid_reserve (struct rio_net * net, u16 destid);
```

Arguments

net RIO network
destid destID to reserve

Description

Tries to reserve the specified destID. Returns 0 if successful.

Name

`rio_destid_free` — free a previously allocated destID

Synopsis

```
void rio_destid_free (struct rio_net * net, u16 destid);
```

Arguments

net RIO network

destid destID to free

Description

Makes the specified destID available for use.

Name

`rio_destid_first` — return first destID in use

Synopsis

```
u16 rio_destid_first (struct rio_net * net);
```

Arguments

net RIO network

Name

`rio_destid_next` — return next destID in use

Synopsis

```
u16 rio_destid_next (struct rio_net * net, u16 from);
```

Arguments

net RIO network

from destination ID from which search shall continue

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

<i>port</i>	RIO master port
<i>destid</i>	Destination ID of device
<i>hopcount</i>	Hopcount to device

Description

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

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

<i>port</i>	RIO master port
<i>destid</i>	Destination ID of device
<i>hopcount</i>	Hopcount to device
<i>did</i>	Device ID value to be written

Description

Writes the base/extended device id from a device.

Name

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

Synopsis

```
int rio_clear_locks (struct rio_net * net);
```

Arguments

net RIO network to run on

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.

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.

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.

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.

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.

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

<i>net</i>	RIO network
<i>port</i>	Master port to send transactions
<i>destid</i>	Current destination ID
<i>hopcount</i>	Current hopcount
<i>do_enum</i>	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.

Name

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

Synopsis

```
int rio_sport_is_active (struct rio_dev * rdev, int sp);
```

Arguments

rdev RapidIO device object

sp 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 `RIO_PORT_N_ERR_STS_PORT_OK` if the port is active or 0 if it is inactive.

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.

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, struct rio_dev * prev, int prev_port);
```

Arguments

<i>net</i>	RIO network being enumerated
<i>port</i>	Master port to send transactions
<i>hopcount</i>	Number of hops into the network
<i>prev</i>	Previous RIO device connected to the enumerated one
<i>prev_port</i>	Port on previous RIO device

Description

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

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 PGCCSR discovered bit for non-zero value (enumeration complete flag). Return 1 if enumeration is complete or 0 if enumeration is incomplete.

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, struct rio_dev * prev, int prev_port);
```

Arguments

<i>net</i>	RIO network being discovered
<i>port</i>	Master port to send transactions
<i>destid</i>	Current destination ID in network
<i>hopcount</i>	Number of hops into the network
<i>prev</i>	previous <code>rio_dev</code>
<i>prev_port</i>	previous port number

Description

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

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 `RIO_PORT_N_ERR_STS_PORT_OK` if the master port is active or 0 if it is inactive.

Name

`rio_update_route_tables` — Updates route tables in switches

Synopsis

```
void rio_update_route_tables (struct rio_net * net);
```

Arguments

net RIO network to run update on

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.

Name

`rio_init_em` — Initializes RIO Error Management (for switches)

Synopsis

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

Arguments

rdev RIO device

Description

For each enumerated switch, call device-specific error management initialization routine (if supplied by the switch driver).

Name

`rio_enum_mport` — Start enumeration through a master port

Synopsis

```
int rio_enum_mport (struct rio_mport * mport, u32 flags);
```

Arguments

mport Master port to send transactions

flags Enumeration control flags

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.

Name

`rio_build_route_tables` — Generate route tables from switch route entries

Synopsis

```
void rio_build_route_tables (struct rio_net * net);
```

Arguments

net RIO network to run route tables scan on

Description

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

Name

`rio_disc_mport` — Start discovery through a master port

Synopsis

```
int rio_disc_mport (struct rio_mport * mport, u32 flags);
```

Arguments

mport Master port to send transactions

flags discovery control flags

Description

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

Name

`rio_basic_attach` —

Synopsis

```
int rio_basic_attach ( void );
```

Arguments

void no arguments

Description

When this enumeration/discovery method is loaded as a module this function registers its specific enumeration and discover routines for all available RapidIO mport devices. The “scan” command line parameter controls ability of the module to start RapidIO enumeration/discovery automatically.

Returns 0 for success or -EIO if unable to register itself.

This enumeration/discovery method cannot be unloaded and therefore does not provide a matching `cleanup_module` routine.

Driver functionality

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,
ul6 src, ul6 dst, ul6 info));
```

Arguments

<i>mport</i>	RIO master port to bind the doorbell callback
<i>dev_id</i>	Device specific pointer to pass on event
<i>res</i>	Doorbell message resource
<i>dinb</i>	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.

Name

`rio_chk_dev_route` — Validate route to the specified device.

Synopsis

```
int rio_chk_dev_route (struct rio_dev * rdev, struct rio_dev ** nrdev,  
int * npnum);
```

Arguments

rdev RIO device failed to respond

nrdev Last active device on the route to *rdev*

npnum *nrdev*'s port number on the route to *rdev*

Description

Follows a route to the specified RIO device to determine the last available device (and corresponding RIO port) on the route.

Name

`rio_chk_dev_access` — Validate access to the specified device.

Synopsis

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

Arguments

rdev Pointer to RIO device control structure

Name

`rio_get_input_status` — Sends a Link-Request/Input-Status control symbol and returns link-response (if requested).

Synopsis

```
int rio_get_input_status (struct rio_dev * rdev, int pnum, u32 * lnkresp);
```

Arguments

rdev RIO device to issue Input-status command

pnum Device port number to issue the command

lnkresp Response from a link partner

Name

`rio_clr_err_stopped` — Clears port Error-stopped states.

Synopsis

```
int rio_clr_err_stopped (struct rio_dev * rdev, u32 pnum, u32 err_s-  
tatus);
```

Arguments

<i>rdev</i>	Pointer to RIO device control structure
<i>pnum</i>	Switch port number to clear errors
<i>err_status</i>	port error status (if 0 reads register from device)

Description

TODO: Currently this routine is not compatible with recovery process specified for idt_gen3 RapidIO switch devices. It has to be reviewed to implement universal recovery process that is compatible full range off available devices. IDT gen3 switch driver now implements HW-specific error handler that issues soft port reset to the port to reset ERR_STOP bits and ackIDs.

Name

`rio_std_route_add_entry` — Add switch route table entry using standard registers defined in RIO specification rev.1.3

Synopsis

```
int rio_std_route_add_entry (struct rio_mport * mport, u16 destid, u8  
hopcount, u16 table, u16 route_destid, u8 route_port);
```

Arguments

<i>mport</i>	Master port to issue transaction
<i>destid</i>	Destination ID of the device
<i>hopcount</i>	Number of switch hops to the device
<i>table</i>	routing table ID (global or port-specific)
<i>route_destid</i>	destID entry in the RT
<i>route_port</i>	destination port for specified destID

Name

`rio_std_route_get_entry` — Read switch route table entry (port number) associated with specified destID using standard registers defined in RIO specification rev.1.3

Synopsis

```
int rio_std_route_get_entry (struct rio_mport * mport, u16 destid, u8  
hopcount, u16 table, u16 route_destid, u8 * route_port);
```

Arguments

<i>mport</i>	Master port to issue transaction
<i>destid</i>	Destination ID of the device
<i>hopcount</i>	Number of switch hops to the device
<i>table</i>	routing table ID (global or port-specific)
<i>route_destid</i>	destID entry in the RT
<i>route_port</i>	returned destination port for specified destID

Name

`rio_std_route_clr_table` — Clear switch route table using standard registers defined in RIO specification rev.1.3.

Synopsis

```
int rio_std_route_clr_table (struct rio_mport * mport, u16 destid, u8  
hopcount, u16 table);
```

Arguments

<i>mport</i>	Master port to issue transaction
<i>destid</i>	Destination ID of the device
<i>hopcount</i>	Number of switch hops to the device
<i>table</i>	routing table ID (global or port-specific)

Name

`rio_find_mport` — find RIO mport by its ID

Synopsis

```
struct rio_mport * rio_find_mport (int mport_id);
```

Arguments

mport_id number (ID) of mport device

Description

Given a RIO mport number, the desired mport is located in the global list of mports. If the mport is found, a pointer to its data structure is returned. If no mport is found, `NULL` is returned.

Name

`rio_mport_scan` — execute enumeration/discovery on the specified mport

Synopsis

```
int rio_mport_scan (int mport_id);
```

Arguments

mport_id number (ID) of mport device

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.

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.

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.

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.

Device model support

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.

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

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.

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.

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 mport device class and RIO bus type with the Linux device model.

Sysfs support

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.

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.

PPC32 support

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

<i>mport</i>	RapidIO master port info
<i>index</i>	ID of RapdiIO interface
<i>offset</i>	Offset into configuration space
<i>len</i>	Length (in bytes) of the maintenance transaction
<i>data</i>	Value to be read into

Description

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

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

<i>mport</i>	RapidIO master port info
<i>index</i>	ID of RapdiIO interface
<i>offset</i>	Offset into configuration space
<i>len</i>	Length (in bytes) of the maintenance transaction
<i>data</i>	Value to be written

Description

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

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

<i>mport</i>	RapidIO master port info
<i>index</i>	ID of RapdiIO interface
<i>destid</i>	Destination ID of transaction
<i>hopcount</i>	Number of hops to target device
<i>offset</i>	Offset into configuration space
<i>len</i>	Length (in bytes) of the maintenance transaction
<i>val</i>	Location to be read into

Description

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

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

<i>mport</i>	RapidIO master port info
<i>index</i>	ID of RapdiIO interface
<i>destid</i>	Destination ID of transaction
<i>hopcount</i>	Number of hops to target device
<i>offset</i>	Offset into configuration space
<i>len</i>	Length (in bytes) of the maintenance transaction
<i>val</i>	Value to be written

Description

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

Name

`fsl_rio_setup` — Setup Freescale PowerPC RapidIO interface

Synopsis

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

Arguments

dev platform_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>
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