SPE Runtime Management Library

Version 2.0

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Chapter 1

Overview

The libspe2 functionality is split into 4 libraries:

- **libspe-base** This library provides the basic infrastructure to manage and use SPEs. The central data structure is a SPE context spe_context. It contains all information necessary to manage an SPE, run code on it, communicate with it, and so on. To use the libspe-base library, the header file **spebase.h** has to be included and and an application needs to link against **libspebase.a** or **libspebase.so**.

- **libspe-event** This is a convenience library for the handling of events generated by an SPE. It is based on libspe-base and epoll. Since the spe_context introduced by libspe-base contains the file descriptors to mailboxes etc, any other event handling mechanism could also be implemented based on libspe-base.

1.1 Terminology

- **main thread** usually the application main thread running on a PPE

- **SPE thread** a thread that uses SPEs. Execution starts on the PPE. Execution shifts between PPE and an SPE back and fro, e.g., PPE services system calls for SPE transparently

1.2 Usage Scenarios

1.2.1 Single-threaded sample

Note: In the new model, it is not necessary to have a main thread - the SPE thread can be the only application thread. It may run parts of its code on PPE and then start an SPE, e.g., for an accelerated function. The main thread is needed only if you want to use multiple SPEs concurrently. The following minimalistic sample illustrates the basic steps:

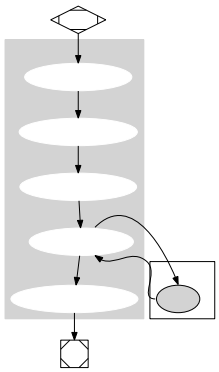


Figure 1.1: Simple program

Here is the same sample with some error checking:

1.2.2 Multi-threaded sample

This illustrates a threaded sample using the pthread library:

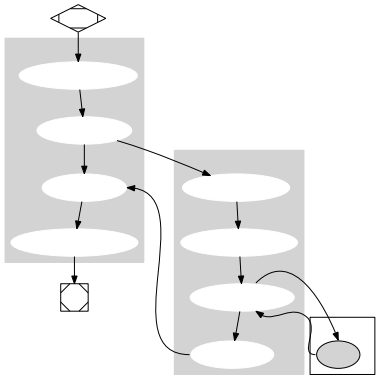


Figure 1.2: Simple pthread program

Here is the same sample with some error checking:

1.2.3 Problem state mapping samples

This illustrates accessing the MFC Local Store Address Register.

1.2.4 Event samples

This illustrates a sample using the event libary. The event, which we receive is of course that the spu program has stopped, because otherwise we would not get there.

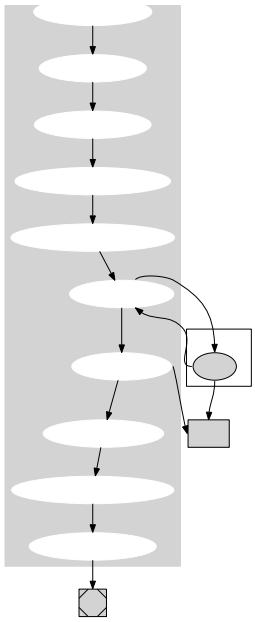


Figure 1.3: Simple event program

Events are more useful in multithreaded environments:

Chapter 2

Data Structure Documentation

2.1 addr64 Union Reference

`#include <elf_loader.h>`

Collaboration diagram for addr64:

Data Fields

- unsigned long long ull
- unsigned int ui [2]

2.1.1 Detailed Description

Definition at line 28 of file elf_loader.h.

2.1.2 Field Documentation

unsigned int ui[2]

Definition at line 31 of file elf_loader.h.

Referenced by _base_spe_context_run().

unsigned long long ull

Definition at line 30 of file elf_loader.h.

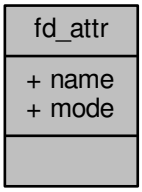
Referenced by _base_spe_context_run().

The documentation for this union was generated from the following file:

- elf_loader.h

2.2 fd_attr Struct Reference

Collaboration diagram for fd_attr:



Data Fields

- const char * name
- int mode

2.2.1 Detailed Description

Definition at line 37 of file create.c.

2.2.2 Field Documentation

int mode

Definition at line 39 of file create.c.
Referenced by _base_spe_open_if_closed().

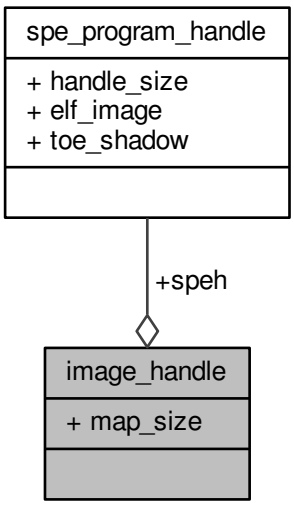
const char* name

Definition at line 38 of file create.c.
Referenced by _base_spe_open_if_closed().
The documentation for this struct was generated from the following file:

- create.c

2.3 image_handle Struct Reference

Collaboration diagram for image_handle:



Data Fields

- spe_program_handle_t speh
- unsigned int map_size

2.3.1 Detailed Description

Definition at line 32 of file image.c.

2.3.2 Field Documentation

unsigned int map_size

Definition at line 34 of file image.c.
Referenced by _base_spe_image_close(), and _base_spe_image_open().

spe_program_handle_t speh

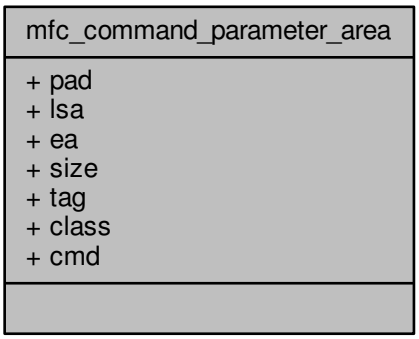
Definition at line 33 of file image.c.
Referenced by _base_spe_image_close(), and _base_spe_image_open().
The documentation for this struct was generated from the following file:

- image.c

2.4 mfc_command_parameter_area Struct Reference

`#include <dma.h>`

Collaboration diagram for mfc_command_parameter_area:



Data Fields

- uint32_t pad
- uint32_t lsa
- uint64_t ea
- uint16_t size
- uint16_t tag
- uint16_t class
- uint16_t cmd

2.4.1 Detailed Description

Definition at line 27 of file dma.h.

2.4.2 Field Documentation

uint16_t class

Definition at line 33 of file dma.h.

uint16_t cmd

Definition at line 34 of file dma.h.

uint64_t ea

Definition at line 30 of file dma.h.

uint32_t lsa

Definition at line 29 of file dma.h.

uint32_t pad

Definition at line 28 of file dma.h.

uint16_t size

Definition at line 31 of file dma.h.

uint16_t tag

Definition at line 32 of file dma.h.

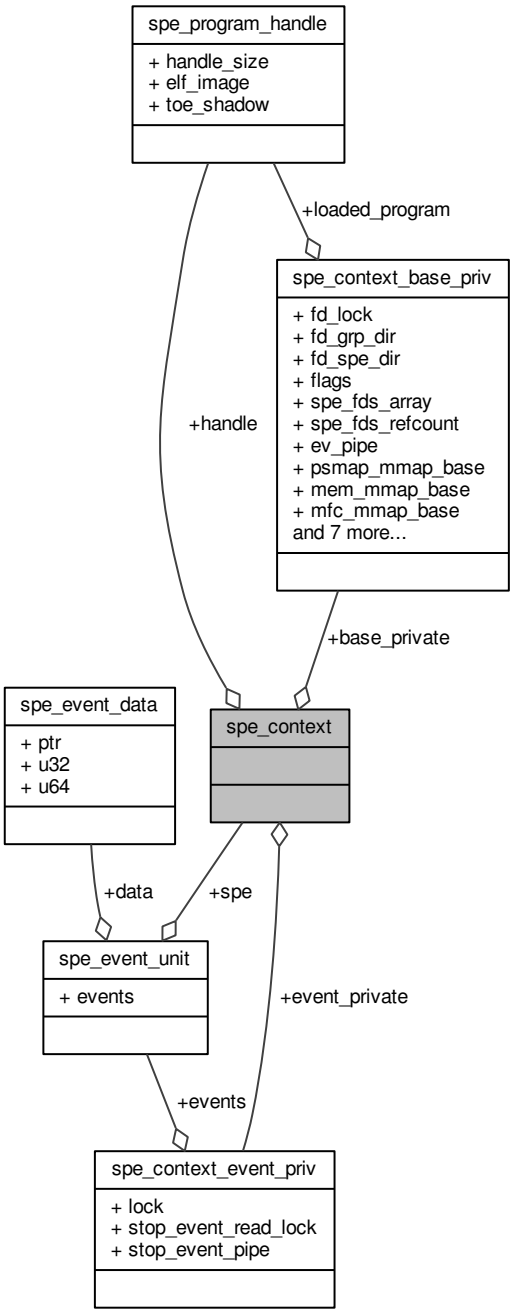
The documentation for this struct was generated from the following file:

- dma.h

2.5 spe_context Struct Reference

```
#include <libspe2-types.h>
```

Collaboration diagram for spe_context:



Data Fields

- spe_program_handle_t handle
- struct spe_context_base_priv * base_private

- struct spe_context_event_priv * event_private

2.5.1 Detailed Description

SPE context The SPE context is one of the base data structures for the libspe2 implementation. It holds all persistent information about a "logical SPE" used by the application. This data structure should not be accessed directly, but the application uses a pointer to an SPE context as an identifier for the "logical SPE" it is dealing with through libspe2 API calls.

Definition at line 64 of file libspe2-types.h.

2.5.2 Field Documentation

struct spe_context_base_priv* base_private

Definition at line 76 of file libspe2-types.h.

Referenced by __base_spe_spe_dir_get(), __base_spe_stop_event_source_get(), __base_spe_stop_event_target_get(), _base_spe_close_if_open(), _base_spe_context_create(), _base_spe_context_lock(), _base_spe_context_run(), _base_spe_context_unlock(), _base_spe_handle_library_callback(), _base_spe_in_mbox_status(), _base_spe_in_mbox_write(), _base_spe_ls_area_get(), _base_spe_mfcio_tag_status_read(), _base_spe_mssync_start(), _base_spe_mssync_status(), _base_spe_open_if_closed(), _base_spe_out_intr_mbox_status(), _base_spe_out_mbox_read(), _base_spe_out_mbox_status(), _base_spe_program_load(), _base_spe_program_load_complete(), _base_spe_ps_area_get(), _base_spe_signal_write(), and _event_spe_event_handler_register().

struct spe_context_event_priv* event_private

Definition at line 77 of file libspe2-types.h.

spe_program_handle_t handle

Definition at line 72 of file libspe2-types.h.

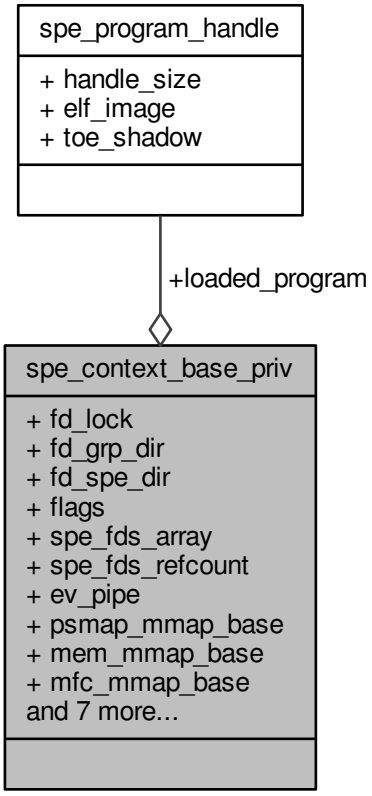
The documentation for this struct was generated from the following file:

- libspe2-types.h

2.6 spe_context_base_priv Struct Reference

```
#include <spebase.h>
```

Collaboration diagram for spe_context_base_priv:



Data Fields

- pthread_mutex_t fd_lock [NUM_MBOX_FDS]
- int fd_grp_dir
- int fd_spe_dir
- unsigned int flags
- int spe_fds_array [NUM_MBOX_FDS]
- int spe_fds_refcount [NUM_MBOX_FDS]
- int ev_pipe [2]
- void * psmap_mmap_base
- void * mem_mmap_base
- void * mfc_mmap_base
- void * mssync_mmap_base
- void * cntl_mmap_base
- void * signal1_mmap_base
- void * signal2_mmap_base
- int entry

- spe_program_handle_t * loaded_program
- int emulated_entry
- int active_tagmask

2.6.1 Detailed Description

Definition at line 61 of file spebase.h.

2.6.2 Field Documentation

int active_tagmask

Definition at line 108 of file spebase.h.
Referenced by _base_spe_mfcio_tag_status_read().

void* cntl_mmap_base

Definition at line 88 of file spebase.h.
Referenced by _base_spe_context_create(), _base_spe_in_mbox_status(), _base_spe_out_intr_mbox_status(), _base_spe_out_mbox_status(), and _base_spe_ps_area_get().

int emulated_entry

Definition at line 103 of file spebase.h.
Referenced by _base_spe_context_run(), and _base_spe_program_load().

int entry

Definition at line 93 of file spebase.h.
Referenced by _base_spe_context_run(), and _base_spe_program_load().

int ev_pipe[2]

Definition at line 81 of file spebase.h.
Referenced by __base_spe_stop_event_source_get(), and __base_spe_stop_event_target_get().

int fd_grp_dir

Definition at line 68 of file spebase.h.

pthread_mutex_t fd_lock[NUM_MBOX_FDS]

Definition at line 65 of file spebase.h.
Referenced by _base_spe_context_create(), _base_spe_context_lock(), and _base_spe_context_unlock().

int fd_spe_dir

Definition at line 71 of file spebase.h.
Referenced by __base_spe_spe_dir_get(), _base_spe_context_create(), _base_spe_context_run(), _base_spe_open_if_closed(), and _base_spe_program_load_complete().

unsigned int flags

Definition at line 74 of file spebase.h.

Referenced by _base_spe_context_create(), _base_spe_context_run(), _base_spe_handle_library_callback(), _base_spe_in_mbox_status(), _base_spe_in_mbox_write(), _base_spe_mfcio_tag_status_read(), _base_spe_mssync_start(), _base_spe_mssync_status(), _base_spe_out_intr_mbox_status(), _base_spe_out_mbox_read(), _base_spe_out_mbox_status(), _base_spe_program_load(), _base_spe_signal_write(), and _event_spe_event_handler_register().

spe_program_handle_t* loaded_program

Definition at line 99 of file spebase.h.

Referenced by _base_spe_context_create(), _base_spe_program_load(), and _base_spe_program_load_complete().

void* mem_mmap_base

Definition at line 85 of file spebase.h.

Referenced by _base_spe_context_create(), _base_spe_context_run(), _base_spe_handle_library_callback(), _base_spe_ls_area_get(), and _base_spe_program_load().

void* mfc_mmap_base

Definition at line 86 of file spebase.h.

Referenced by _base_spe_context_create(), and _base_spe_ps_area_get().

void* mssync_mmap_base

Definition at line 87 of file spebase.h.

Referenced by _base_spe_context_create(), _base_spe_mssync_start(), _base_spe_mssync_status(), and _base_spe_ps_area_get().

void* psmap_mmap_base

Definition at line 84 of file spebase.h.

Referenced by _base_spe_context_create().

void* signal1_mmap_base

Definition at line 89 of file spebase.h.

Referenced by _base_spe_context_create(), _base_spe_ps_area_get(), and _base_spe_signal_write().

void* signal2_mmap_base

Definition at line 90 of file spebase.h.

Referenced by _base_spe_context_create(), _base_spe_ps_area_get(), and _base_spe_signal_write().

int spe_fds_array[NUM_MBOX_FDS]

Definition at line 77 of file spebase.h.

Referenced by _base_spe_close_if_open(), _base_spe_context_create(), and _base_spe_open_if_closed().

int spe_fds_refcount[NUM_MBOX_FDS]

Definition at line 78 of file spebase.h.

Referenced by _base_spe_close_if_open(), and _base_spe_open_if_closed().

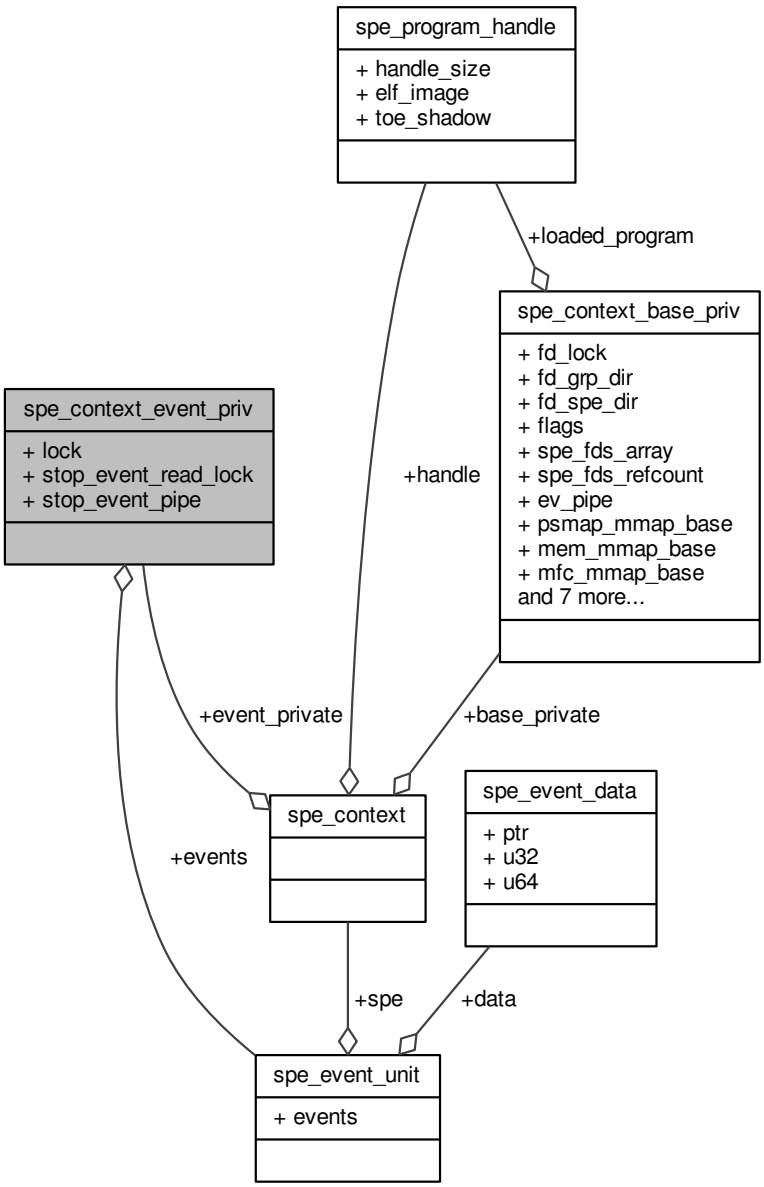
The documentation for this struct was generated from the following file:

- spebase.h

2.7 spe_context_event_priv Struct Reference

```
#include <speevent.h>
```

Collaboration diagram for spe_context_event_priv:



Data Fields

- pthread_mutex_t lock
- pthread_mutex_t stop_event_read_lock
- int stop_event_pipe [2]
- spe_event_unit_t events [__NUM_SPE_EVENT_TYPES]

2.7.1 Detailed Description

Definition at line 35 of file speevent.h.

2.7.2 Field Documentation

spe_event_unit_t events[__NUM_SPE_EVENT_TYPES]

Definition at line 40 of file speevent.h.

Referenced by _event_spe_context_initialize(), _event_spe_event_handler_deregister(), and _event_spe_event_handler_register().

pthread_mutex_t lock

Definition at line 37 of file speevent.h.

Referenced by _event_spe_context_finalize(), and _event_spe_context_initialize().

int stop_event_pipe[2]

Definition at line 39 of file speevent.h.

Referenced by _event_spe_context_finalize(), _event_spe_context_initialize(), _event_spe_context_run(), _event_spe_event_handler_deregister(), _event_spe_event_handler_register(), and _event_spe_stop_info_read().

pthread_mutex_t stop_event_read_lock

Definition at line 38 of file speevent.h.

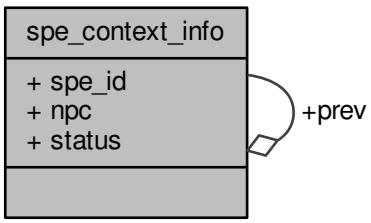
Referenced by _event_spe_context_finalize(), _event_spe_context_initialize(), and _event_spe_stop_info_read().

The documentation for this struct was generated from the following file:

- speevent.h

2.8 spe_context_info Struct Reference

Collaboration diagram for spe_context_info:



Data Fields

- int spe_id
- unsigned int npc
- unsigned int status
- struct spe_context_info * prev

2.8.1 Detailed Description

Definition at line 40 of file run.c.

2.8.2 Field Documentation

unsigned int npc

Definition at line 42 of file run.c.
Referenced by _base_spe_context_run().

struct spe_context_info* prev

Definition at line 44 of file run.c.
Referenced by _base_spe_context_run().

int spe_id

Definition at line 41 of file run.c.
Referenced by _base_spe_context_run().

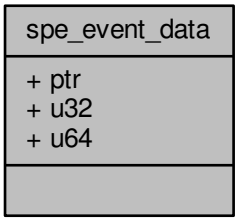
unsigned int status

Definition at line 43 of file run.c.
Referenced by _base_spe_context_run().
The documentation for this struct was generated from the following file:

- run.c

2.9 spe_event_data Union Reference

`#include <libspe2-types.h>`
Collaboration diagram for spe_event_data:



Data Fields

- void * ptr
- unsigned int u32
- unsigned long long u64

2.9.1 Detailed Description

spe_event_data_t User data to be associated with an event

Definition at line 143 of file libspe2-types.h.

2.9.2 Field Documentation

void* ptr

Definition at line 145 of file libspe2-types.h.

Referenced by _event_spe_event_handler_register().

unsigned int u32

Definition at line 146 of file libspe2-types.h.

unsigned long long u64

Definition at line 147 of file libspe2-types.h.

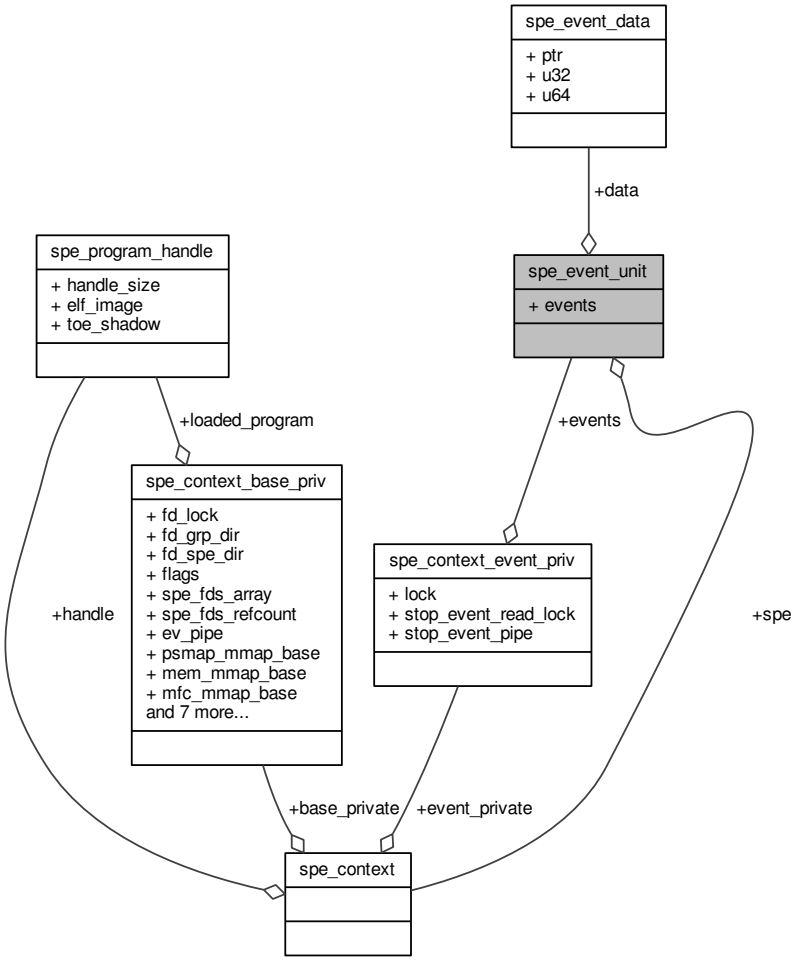
The documentation for this union was generated from the following file:

- libspe2-types.h

2.10 spe_event_unit Struct Reference

```
#include <libspe2-types.h>
```

Collaboration diagram for spe_event_unit:



Data Fields

- unsigned int events
- spe_context_ptr_t spe
- spe_event_data_t data

2.10.1 Detailed Description

spe_event_t

Definition at line 152 of file libspe2-types.h.

2.10.2 Field Documentation

spe_event_data_t data

Definition at line 156 of file libspe2-types.h.

Referenced by _event_spe_event_handler_register().

unsigned int events

Definition at line 154 of file libspe2-types.h.
Referenced by _event_spe_event_handler_deregister(), and _event_spe_event_handler_register().

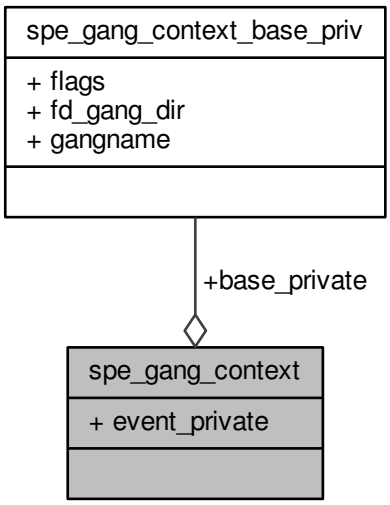
spe_context_ptr_t spe

Definition at line 155 of file libspe2-types.h.
Referenced by _event_spe_context_initialize(), _event_spe_event_handler_deregister(), _event_spe_event_handler_register(), and _event_spe_event_wait().
The documentation for this struct was generated from the following file:

- libspe2-types.h

2.11 spe_gang_context Struct Reference

`#include <libspe2-types.h>`
Collaboration diagram for spe_gang_context:



Data Fields

- struct spe_gang_context_base_priv * base_private
- struct spe_gang_context_event_priv * event_private

2.11.1 Detailed Description

SPE gang context The SPE gang context is one of the base data structures for the libspe2 implementation. It holds all persistent information about a group of SPE contexts that should be treated as a gang, i.e., be execute together with certain properties. This data structure should not be accessed directly, but the application uses a pointer to an SPE gang context as an identifier for the SPE gang it is dealing with through libspe2 API calls.

Definition at line 94 of file libspe2-types.h.

2.11.2 Field Documentation

struct spe_gang_context_base_priv* base_private

Definition at line 99 of file libspe2-types.h.

Referenced by _base_spe_context_create(), and _base_spe_gang_context_create().

struct spe_gang_context_event_priv* event_private

Definition at line 100 of file libspe2-types.h.

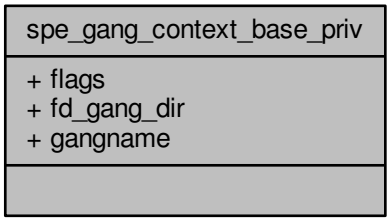
The documentation for this struct was generated from the following file:

- libspe2-types.h

2.12 spe_gang_context_base_priv Struct Reference

`#include <spebase.h>`

Collaboration diagram for spe_gang_context_base_priv:



Data Fields

- unsigned int flags
- int fd_gang_dir
- char gangname [256]

2.12.1 Detailed Description

spe_context: This holds the persistant information of a SPU instance it is created by spe_create_context()

Definition at line 150 of file spebase.h.

2.12.2 Field Documentation

int fd_gang_dir

Definition at line 156 of file spebase.h.

unsigned int flags

Definition at line 153 of file spebase.h.

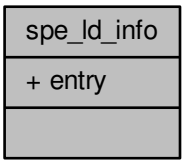
char gangname[256]

Definition at line 158 of file spebase.h.
Referenced by _base_spe_context_create(), and _base_spe_gang_context_create().
The documentation for this struct was generated from the following file:

- spebase.h

2.13 spe_ld_info Struct Reference

`#include <elf_loader.h>`
Collaboration diagram for spe_ld_info:



Data Fields

- unsigned int entry

2.13.1 Detailed Description

Definition at line 34 of file elf_loader.h.

2.13.2 Field Documentation

unsigned int entry

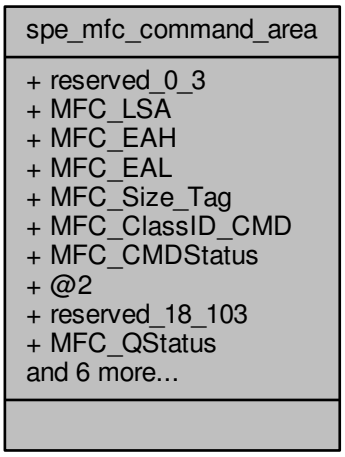
Definition at line 36 of file elf_loader.h.
Referenced by _base_spe_load_spe_elf(), and _base_spe_program_load().
The documentation for this struct was generated from the following file:

- elf_loader.h

2.14 spe_mfc_command_area Struct Reference

`#include <cbea_map.h>`

Collaboration diagram for spe_mfc_command_area:



Data Fields

- unsigned char reserved_0_3 [4]
- unsigned int MFC_LSA
- unsigned int MFC_EAH
- unsigned int MFC_EAL
- unsigned int MFC_Size_Tag
- union {
  unsigned int MFC_ClassID_CMD
  unsigned int MFC_CMDStatus
  };

- unsigned char reserved_18_103 [236]
- unsigned int MFC_QStatus
- unsigned char reserved_108_203 [252]
- unsigned int Prxy_QueryType
- unsigned char reserved_208_21B [20]
- unsigned int Prxy_QueryMask
- unsigned char reserved_220_22B [12]
- unsigned int Prxy_TagStatus

2.14.1 Detailed Description

Definition at line 34 of file cbea_map.h.

2.14.2 Field Documentation

union { **...** }

unsigned int MFC_ClassID_CMD

Definition at line 41 of file cbea_map.h.

unsigned int MFC_CMDStatus

Definition at line 42 of file cbea_map.h.

unsigned int MFC_EAH

Definition at line 37 of file cbea_map.h.

unsigned int MFC_EAL

Definition at line 38 of file cbea_map.h.

unsigned int MFC_LSA

Definition at line 36 of file cbea_map.h.

unsigned int MFC_QStatus

Definition at line 45 of file cbea_map.h.

unsigned int MFC_Size_Tag

Definition at line 39 of file cbea_map.h.

unsigned int Prxy_QueryMask

Definition at line 49 of file cbea_map.h.

unsigned int Prxy_QueryType

Definition at line 47 of file cbea_map.h.

unsigned int Prxy_TagStatus

Definition at line 51 of file cbea_map.h.

unsigned char reserved_0_3[4]

Definition at line 35 of file cbea_map.h.

unsigned char reserved_108_203[252]

Definition at line 46 of file cbea_map.h.

unsigned char reserved_18_103[236]

Definition at line 44 of file cbea_map.h.

unsigned char reserved_208_21B[20]

Definition at line 48 of file cbea_map.h.

unsigned char reserved_220_22B[12]

Definition at line 50 of file cbea_map.h.

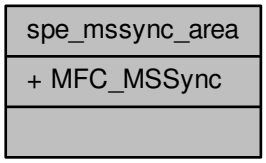
The documentation for this struct was generated from the following file:

- cbea_map.h

2.15 spe_mssync_area Struct Reference

`#include <cbea_map.h>`

Collaboration diagram for spe_mssync_area:



Data Fields

- unsigned int MFC_MSSync

2.15.1 Detailed Description

Definition at line 30 of file cbea_map.h.

2.15.2 Field Documentation

unsigned int MFC_MSSync

Definition at line 31 of file cbea_map.h.

Referenced by _base_spe_mssync_start(), and _base_spe_mssync_status().

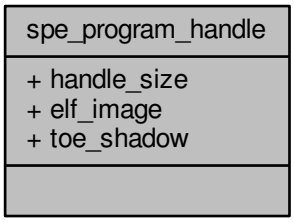
The documentation for this struct was generated from the following file:

- cbea_map.h

2.16 spe_program_handle Struct Reference

`#include <libspe2-types.h>`

Collaboration diagram for spe_program_handle:



Data Fields

- unsigned int handle_size
- void * elf_image
- void * toe_shadow

2.16.1 Detailed Description

SPE program handle Structure spe_program_handle per CESOF specification libspe2 applications usually only keep a pointer to the program handle and do not use the structure directly.

Definition at line 43 of file libspe2-types.h.

2.16.2 Field Documentation

void* elf_image

Definition at line 50 of file libspe2-types.h.

Referenced by _base_spe_image_close(), _base_spe_image_open(), _base_spe_load_spe_elf(), _base_spe_parse_isolated_elf(), _base_spe_program_load_complete(), _base_spe_toe_ear(), and _base_spe_verify_spe_elf_image().

unsigned int handle_size

Definition at line 49 of file libspe2-types.h.

Referenced by _base_spe_image_open().

void* toe_shadow

Definition at line 51 of file libspe2-types.h.

Referenced by _base_spe_image_close(), _base_spe_image_open(), and _base_spe_toe_ear().

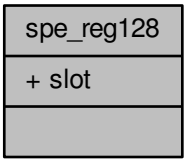
The documentation for this struct was generated from the following file:

- libspe2-types.h

2.17 spe_reg128 Struct Reference

`#include <handler_utils.h>`

Collaboration diagram for spe_reg128:



Data Fields

- unsigned int slot [4]

2.17.1 Detailed Description

Definition at line 23 of file handler_utils.h.

2.17.2 Field Documentation

unsigned int slot[4]

Definition at line 24 of file handler_utils.h.

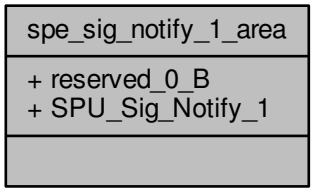
The documentation for this struct was generated from the following file:

- handler_utils.h

2.18 spe_sig_notify_1_area Struct Reference

`#include <cbea_map.h>`

Collaboration diagram for spe_sig_notify_1_area:



Data Fields

- unsigned char reserved_0_B [12]
- unsigned int SPU_Sig_Notify_1

2.18.1 Detailed Description

Definition at line 69 of file cbea_map.h.

2.18.2 Field Documentation

unsigned char reserved_0_B[12]

Definition at line 70 of file cbea_map.h.

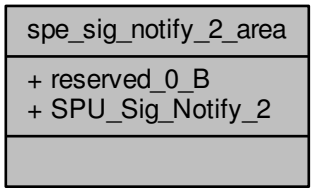
unsigned int SPU_Sig_Notify_1

Definition at line 71 of file cbea_map.h.
Referenced by _base_spe_signal_write().
The documentation for this struct was generated from the following file:

- cbea_map.h

2.19 spe_sig_notify_2_area Struct Reference

`#include <cbea_map.h>`
Collaboration diagram for spe_sig_notify_2_area:



Data Fields

- unsigned char reserved_0_B [12]
- unsigned int SPU_Sig_Notify_2

2.19.1 Detailed Description

Definition at line 74 of file cbea_map.h.

2.19.2 Field Documentation

unsigned char reserved_0_B[12]

Definition at line 75 of file cbea_map.h.

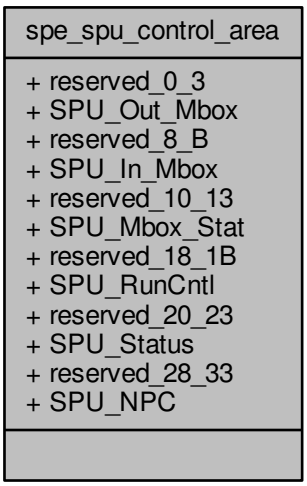
unsigned int SPU_Sig_Notify_2

Definition at line 76 of file cbea_map.h.
Referenced by _base_spe_signal_write().
The documentation for this struct was generated from the following file:

- cbea_map.h

2.20 spe_spu_control_area Struct Reference

`#include <cbea_map.h>`
Collaboration diagram for spe_spu_control_area:



Data Fields

- unsigned char reserved_0_3 [4]
- unsigned int SPU_Out_Mbox
- unsigned char reserved_8_B [4]
- unsigned int SPU_In_Mbox
- unsigned char reserved_10_13 [4]
- unsigned int SPU_Mbox_Stat
- unsigned char reserved_18_1B [4]
- unsigned int SPU_RunCntl
- unsigned char reserved_20_23 [4]

- unsigned int SPU_Status
- unsigned char reserved_28_33 [12]
- unsigned int SPU_NPC

2.20.1 Detailed Description

Definition at line 54 of file cbea_map.h.

2.20.2 Field Documentation

unsigned char reserved_0_3[4]

Definition at line 55 of file cbea_map.h.

unsigned char reserved_10_13[4]

Definition at line 59 of file cbea_map.h.

unsigned char reserved_18_1B[4]

Definition at line 61 of file cbea_map.h.

unsigned char reserved_20_23[4]

Definition at line 63 of file cbea_map.h.

unsigned char reserved_28_33[12]

Definition at line 65 of file cbea_map.h.

unsigned char reserved_8_B[4]

Definition at line 57 of file cbea_map.h.

unsigned int SPU_In_Mbox

Definition at line 58 of file cbea_map.h.

unsigned int SPU_Mbox_Stat

Definition at line 60 of file cbea_map.h.
Referenced by _base_spe_in_mbox_status(), _base_spe_out_intr_mbox_status(), and _base_spe_out_mbox_status().

unsigned int SPU_NPC

Definition at line 66 of file cbea_map.h.

unsigned int SPU_Out_Mbox

Definition at line 56 of file cbea_map.h.

unsigned int SPU_RunCntl

Definition at line 62 of file cbea_map.h.

unsigned int SPU_Status

Definition at line 64 of file cbea_map.h.

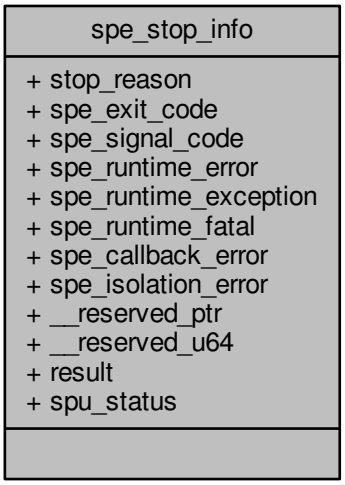
The documentation for this struct was generated from the following file:

- cbea_map.h

2.21 spe_stop_info Struct Reference

`#include <libspe2-types.h>`

Collaboration diagram for spe_stop_info:



Data Fields

- unsigned int stop_reason
- union {
  int spe_exit_code
  int spe_signal_code
  int spe_runtime_error
  int spe_runtime_exception
  int spe_runtime_fatal
  int spe_callback_error
  int spe_isolation_error
  void * __reserved_ptr
  unsigned long long __reserved_u64
  } result
- int spu_status

2.21.1 Detailed Description

spe_stop_info_t
Definition at line 118 of file libspe2-types.h.

2.21.2 Field Documentation

void* __reserved_ptr

Definition at line 129 of file libspe2-types.h.

unsigned long long __reserved_u64

Definition at line 130 of file libspe2-types.h.

union { ... } result

Referenced by _base_spe_context_run().

int spe_callback_error

Definition at line 126 of file libspe2-types.h.
Referenced by _base_spe_context_run().

int spe_exit_code

Definition at line 121 of file libspe2-types.h.
Referenced by _base_spe_context_run().

int spe_isolation_error

Definition at line 127 of file libspe2-types.h.
Referenced by _base_spe_context_run().

int spe_runtime_error

Definition at line 123 of file libspe2-types.h.
Referenced by _base_spe_context_run().

int spe_runtime_exception

Definition at line 124 of file libspe2-types.h.
Referenced by _base_spe_context_run().

int spe_runtime_fatal

Definition at line 125 of file libspe2-types.h.
Referenced by _base_spe_context_run().

int spe_signal_code

Definition at line 122 of file libspe2-types.h.
Referenced by _base_spe_context_run().

int spu_status

Definition at line 132 of file libspe2-types.h.
Referenced by _base_spe_context_run().

unsigned int stop_reason

Definition at line 119 of file libspe2-types.h.
Referenced by _base_spe_context_run().
The documentation for this struct was generated from the following file:

- libspe2-types.h

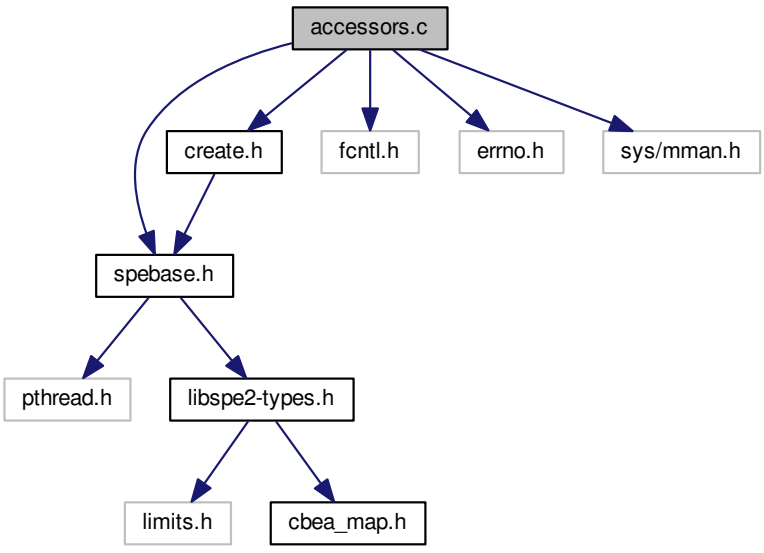
Chapter 3

File Documentation

3.1 accessors.c File Reference

```
#include "spebase.h"
#include "create.h"
#include <fcntl.h>
#include <errno.h>
#include <sys/mman.h>
```

Include dependency graph for accessors.c:



Functions

- void * _base_spe_ps_area_get (spe_context_ptr_t spe, enum ps_area area)
- void * _base_spe_ls_area_get (spe_context_ptr_t spe)
- __attribute__ ((noinline))

- int __base_spe_event_source_acquire (spe_context_ptr_t spe, enum fd_name fdesc)
- void __base_spe_event_source_release (struct spe_context *spe, enum fd_name fdesc)
- int __base_spe_spe_dir_get (spe_context_ptr_t spe)
- int __base_spe_stop_event_source_get (spe_context_ptr_t spe)
- int __base_spe_stop_event_target_get (spe_context_ptr_t spe)
- int _base_spe_ls_size_get (spe_context_ptr_t spe)

3.1.1 Function Documentation

__attribute__ ((noinline))

Definition at line 69 of file accessors.c.

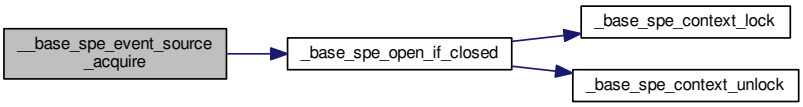
```
70 {
71         return;
72 }
```

int __base_spe_event_source_acquire (spe_context_ptr_t *spe*, enum fd_name *fdesc*)

Definition at line 74 of file accessors.c.
References _base_spe_open_if_closed().
Referenced by _event_spe_event_handler_deregister(), and _event_spe_event_handler_register().

```
75 {
76         return _base_spe_open_if_closed(spe, fdesc, 0);
77 }
```

Here is the call graph for this function:



void __base_spe_event_source_release (struct spe_context * *spectx*, enum fd_name *fdesc*)

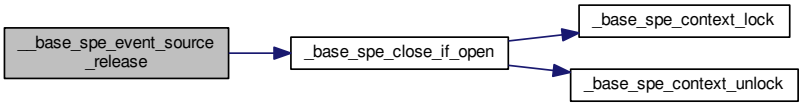
__base_spe_event_source_release releases the file descriptor to the specified event source
Parameters

spectx	Specifies the SPE context
fdesc	Specifies the event source

Definition at line 79 of file accessors.c.
References _base_spe_close_if_open().

```
80 {
81         _base_spe_close_if_open(spe, fdesc);
82 }
```

Here is the call graph for this function:



int __base_spe_spe_dir_get (spe_context_ptr_t *spe*)

Definition at line 84 of file accessors.c.
References spe_context::base_private, and spe_context_base_priv::fd_spe_dir.

```
85 {
86         return spe->base_private->fd_spe_dir;
87 }
```

int __base_spe_stop_event_source_get (spe_context_ptr_t *spe*)

speevent users read from this end
Definition at line 92 of file accessors.c.
References spe_context::base_private, and spe_context_base_priv::ev_pipe.

```
93 {
94         return spe->base_private->ev_pipe[1];
95 }
```

int __base_spe_stop_event_target_get (spe_context_ptr_t *spe*)

speevent writes to this end
Definition at line 100 of file accessors.c.
References spe_context::base_private, and spe_context_base_priv::ev_pipe.

```
101 {
102          return spe->base_private->ev_pipe[0];
103 }
```

void* _base_spe_ls_area_get (spe_context_ptr_t *spe*)

Definition at line 64 of file accessors.c.
References spe_context::base_private, and spe_context_base_priv::mem_mmap_base.

```
65 {
66         return spe->base_private->mem_mmap_base;
67 }
```

int _base_spe_ls_size_get (spe_context_ptr_t *spe*)

_base_spe_ls_size_get returns the size of the local store area

Parameters

spectx	Specifies the SPE context

Definition at line 105 of file accessors.c.

References LS_SIZE.

```
106 {
107         return LS_SIZE;
108 }
```

void* _base_spe_ps_area_get (spe_context_ptr_t *spe*, enum ps_area *area*)

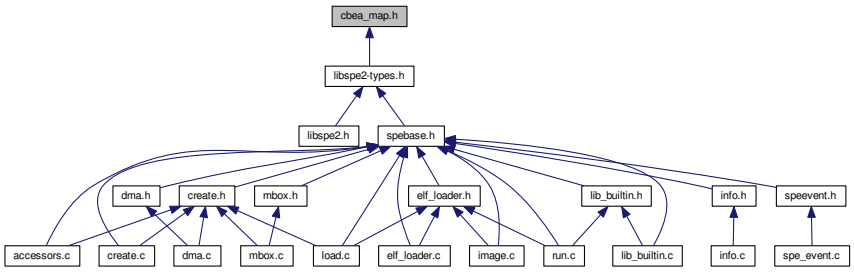
Definition at line 30 of file accessors.c.

References spe_context::base_private, spe_context_base_priv::cntl_mmap_base, spe_context_base_priv::mfc_mmap_base, spe_context_base_priv::mssync_mmap_base, spe_context_base_priv::signal1_mmap_base, spe_context_base_priv::signal2_mmap_base, SPE_CONTROL_AREA, SPE_MFC_COMMAND_AREA, SPE_MSSYNC_AREA, SPE_SIG_NOTIFY_1_AREA, and SPE_SIG_NOTIFY_2_AREA.

```
31 {
32         void *ptr;
33 
34         switch (area) {
35                 case SPE_MSSYNC_AREA:
36                         ptr = spe->base_private->mssync_mmap_base;
37                         break;
38                 case SPE_MFC_COMMAND_AREA:
39                         ptr = spe->base_private->mfc_mmap_base;
40                         break;
41                 case SPE_CONTROL_AREA:
42                         ptr = spe->base_private->cntl_mmap_base;
43                         break;
44                 case SPE_SIG_NOTIFY_1_AREA:
45                         ptr = spe->base_private->signal1_mmap_base;
46                         break;
47                 case SPE_SIG_NOTIFY_2_AREA:
48                         ptr = spe->base_private->signal2_mmap_base;
49                         break;
50                 default:
51                         errno = EINVAL;
52                         return NULL;
53                         break;
54         }
55 
56         if (ptr == MAP_FAILED) {
57                 errno = EACCES;
58                 return NULL;
59         }
60 
61         return ptr;
62 }
```

3.2 cbea_map.h File Reference

This graph shows which files directly or indirectly include this file:



Data Structures

- struct spe_mssync_area
- struct spe_mfc_command_area
- struct spe_spu_control_area
- struct spe_sig_notify_1_area
- struct spe_sig_notify_2_area

Typedefs

- typedef struct spe_mssync_area spe_mssync_area_t
- typedef struct spe_mfc_command_area spe_mfc_command_area_t
- typedef struct spe_spu_control_area spe_spu_control_area_t
- typedef struct spe_sig_notify_1_area spe_sig_notify_1_area_t
- typedef struct spe_sig_notify_2_area spe_sig_notify_2_area_t

3.2.1 Typedef Documentation

typedef struct spe_mfc_command_area spe_mfc_command_area_t

typedef struct spe_mssync_area spe_mssync_area_t

typedef struct spe_sig_notify_1_area spe_sig_notify_1_area_t

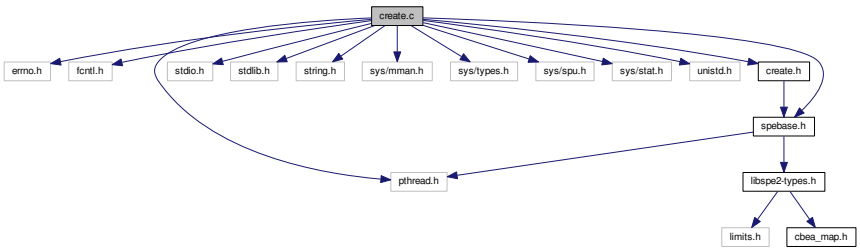
typedef struct spe_sig_notify_2_area spe_sig_notify_2_area_t

typedef struct spe_spu_control_area spe_spu_control_area_t

3.3 create.c File Reference

```
#include <errno.h>
#include <fcntl.h>
#include <pthread.h>
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <sys/mman.h>
#include <sys/types.h>
#include <sys/spu.h>
#include <sys/stat.h>
#include <unistd.h>
#include "create.h"
#include "spebase.h"
```

Include dependency graph for create.c:



Data Structures

- struct fd_attr

Functions

- void _base_spe_context_lock (spe_context_ptr_t spe, enum fd_name fdesc)
- void _base_spe_context_unlock (spe_context_ptr_t spe, enum fd_name fdesc)
- int _base_spe_open_if_closed (struct spe_context *spe, enum fd_name fdesc, int locked)
- void _base_spe_close_if_open (struct spe_context *spe, enum fd_name fdesc)
- spe_context_ptr_t _base_spe_context_create (unsigned int flags, spe_gang_context_ptr_t gctx, spe_context_ptr_t aff_spe)
- spe_gang_context_ptr_t _base_spe_gang_context_create (unsigned int flags)
- int _base_spe_context_destroy (spe_context_ptr_t spe)
- int _base_spe_gang_context_destroy (spe_gang_context_ptr_t gctx)

3.3.1 Function Documentation

void _base_spe_close_if_open (struct spe_context * *spe*, enum fd_name *fdesc*)

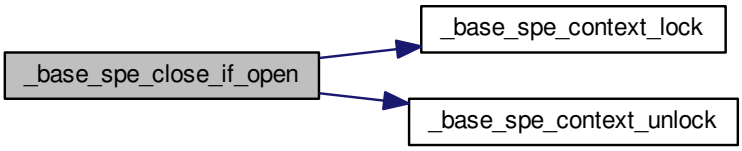
Definition at line 125 of file create.c.

References _base_spe_context_lock(), _base_spe_context_unlock(), spe_context::base_private, spe_context_base_priv::spe_fds_array, and spe_context_base_priv::spe_fds_refcount.

Referenced by __base_spe_event_source_release(), and _base_spe_signal_write().

```
126 {
127         _base_spe_context_lock(spe, fdesc);
128
129         if (spe->base_private->spe_fds_array[(int)fdesc] != -1 &&
130                 spe->base_private->spe_fds_refcount[(int)fdesc] == 1) {
131
132                 spe->base_private->spe_fds_refcount[(int)fdesc]--;
133                 close(spe->base_private->spe_fds_array[(int)fdesc]);
134
135                 spe->base_private->spe_fds_array[(int)fdesc] = -1;
136         } else if (spe->base_private->spe_fds_refcount[(int)fdesc] > 0) {
137                 spe->base_private->spe_fds_refcount[(int)fdesc]--;
138         }
139
140         _base_spe_context_unlock(spe, fdesc);
141 }
```

Here is the call graph for this function:



spe_context_ptr_t _base_spe_context_create (unsigned int *flags*, spe_gang_context_ptr_t *gctx*, spe_context_ptr_t *aff_spe*)

_base_spe_context_create creates a single SPE context, i.e., the corresponding directory is created in SPUFS either as a subdirectory of a gang or individually (maybe this is best considered a gang of one)

Parameters

flags	
gctx	specify NULL if not belonging to a gang
aff_spe	specify NULL to skip affinity information

Definition at line 183 of file create.c.

References _base_spe_emulated_loader_present(), spe_context::base_private, spe_gang_context::base_private, spe_context_base_priv::cntl_mmap_base, CNTL_OFFSET, CNTL_SIZE, DEBUG_PRINTF, spe_context_base_priv::fd_lock, spe_context_base_priv::fd_spe_dir, spe_context_base_priv::flags, spe_gang_context_base_priv::gangname, spe_context_base_priv::loaded_program, LS_SIZE, spe_context_base_priv::mem_mmap_base, spe_context_base_priv::mfc_mmap_base, MFC_OFFSET, MFC_SIZE, MSS_SIZE, spe_context_base_priv::mssync_mmap_base, MSSYNC_OFFSET, NUM_MBOX_FDS, spe_context_base_priv::psmap_mmap_base, PSMAP_SIZE, spe_context_base_priv::signal1_mmap_base, SIGNAL1_OFFSET, spe_context_base_priv::signal2_mmap_base, SIGNAL2_OFFSET, SIGNAL_SIZE, SPE_AFFINITY_MEMORY, SPE_CFG_-

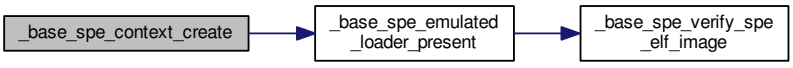
SIGNOTIFY1_OR, SPE_CFG_SIGNOTIFY2_OR, SPE_EVENTS_ENABLE, spe_context_base_priv::spe_-fds_array, SPE_ISOLATE, SPE_ISOLATE_EMULATE, and SPE_MAP_PS.

```
185 {
186         char pathname[256];
187         int i, aff_spe_fd = 0;
188         unsigned int spu_createflags = 0;
189         struct spe_context *spe = NULL;
190         struct spe_context_base_priv *priv;
191 
192         /* We need a loader present to run in emulated isolated mode */
193         if (flags & SPE_ISOLATE_EMULATE
194                         && !base_spe_emulated_loader_present()) {
195                 errno = EINVAL;
196                 return NULL;
197         }
198 
199         /* Put some sane defaults into the SPE context */
200         spe = malloc(sizeof(*spe));
201         if (!spe) {
202                 DEBUG_PRINTF("ERROR: Could not allocate spe context.\n");
203                 return NULL;
204         }
205         memset(spe, 0, sizeof(*spe));
206 
207         spe->base_private = malloc(sizeof(*spe->base_private));
208         if (!spe->base_private) {
209                 DEBUG_PRINTF("ERROR: Could not allocate "
210                                 "spe->base_private context.\n");
211                 free(spe);
212                 return NULL;
213         }
214 
215         /* just a convenience variable */
216         priv = spe->base_private;
217 
218         priv->fd_spe_dir = -1;
219         priv->mem_mmap_base = MAP_FAILED;
220         priv->psmap_mmap_base = MAP_FAILED;
221         priv->mssync_mmap_base = MAP_FAILED;
222         priv->mfc_mmap_base = MAP_FAILED;
223         priv->cntl_mmap_base = MAP_FAILED;
224         priv->signal1_mmap_base = MAP_FAILED;
225         priv->signal2_mmap_base = MAP_FAILED;
226         priv->loaded_program = NULL;
227 
228         for (i = 0; i < NUM_MBOX_FDS; i++) {
229                 priv->spe_fds_array[i] = -1;
230                 pthread_mutex_init(&priv->fd_lock[i], NULL);
231         }
232 
233         /* initialise spu_createflags */
234         if (flags & SPE_ISOLATE) {
235                 flags |= SPE_MAP_PS;
236                 spu_createflags |= SPU_CREATE_ISOLATE | SPU_CREATE_NOSCHED;
237         }
238 
239         if (flags & SPE_EVENTS_ENABLE)
240                 spu_createflags |= SPU_CREATE_EVENTS_ENABLED;
241 
242         if (aff_spe)
243                 spu_createflags |= SPU_CREATE_AFFINITY_SPU;
244 
245         if (flags & SPE_AFFINITY_MEMORY)
246                 spu_createflags |= SPU_CREATE_AFFINITY_MEM;
247 
248         /* Make the SPUFS directory for the SPE */
249         if (gctx == NULL)
250                 sprintf(pathname, "/spu/spethread-%i-%lu",
251                         getpid(), (unsigned long)spe);
252         else
253                 sprintf(pathname, "/spu/%s/spethread-%i-%lu",
254                         gctx->base_private->gangname, getpid(),
255                         (unsigned long)spe);
256 
257         if (aff_spe)
258                 aff_spe_fd = aff_spe->base_private->fd_spe_dir;
259 
260         priv->fd_spe_dir = spu_create(pathname, spu_createflags,
261                         S_IRUSR | S_IWUSR | S_IXUSR, aff_spe_fd);
```

```
262
263         if (priv->fd_spe_dir < 0) {
264                 int errno_saved = errno; /* save errno to prevent being overwritten */
265                 DEBUG_PRINTF("ERROR: Could not create SPE %s\n", pathname);
266                 perror("spu_create()");
267                 free_spe_context(spe);
268                 /* we mask most errors, but leave ENODEV, etc */
269                 switch (errno_saved) {
270                 case ENOTSUP:
271                 case EEXIST:
272                 case EINVAL:
273                 case EBUSY:
274                 case EPERM:
275                 case ENODEV:
276                         errno = errno_saved; /* restore errno */
277                         break;
278                 default:
279                         errno = EFAULT;
280                         break;
281                 }
282                 return NULL;
283         }
284
285         priv->flags = flags;
286
287         /* Map the required areas into process memory */
288         priv->mem_mmap_base = mapfileat(priv->fd_spe_dir, "mem",
    LS_SIZE);
289         if (priv->mem_mmap_base == MAP_FAILED) {
290                 DEBUG_PRINTF("ERROR: Could not map SPE memory.\n");
291                 free_spe_context(spe);
292                 errno = ENOMEM;
293                 return NULL;
294         }
295
296         if (flags & SPE_MAP_PS) {
297                 /* It's possible to map the entire problem state area with
298                  * one mmap - try this first */
299                 priv->psmap_mmap_base =  mapfileat(priv->
    fd_spe_dir,
300                                 "psmap", PSMAP_SIZE);
301
302                 if (priv->psmap_mmap_base != MAP_FAILED) {
303                         priv->mssync_mmap_base =
304                                 priv->psmap_mmap_base +
    MSSYNC_OFFSET;
305                         priv->mfc_mmap_base =
306                                 priv->psmap_mmap_base +
    MFC_OFFSET;
307                         priv->cntl_mmap_base =
308                                 priv->psmap_mmap_base +
    CNTL_OFFSET;
309                         priv->signal1_mmap_base =
310                                 priv->psmap_mmap_base +
    SIGNAL1_OFFSET;
311                         priv->signal2_mmap_base =
312                                 priv->psmap_mmap_base +
    SIGNAL2_OFFSET;
313
314                 } else {
315                         /* map each region separately */
316                         priv->mfc_mmap_base =
317                                 mapfileat(priv->fd_spe_dir, "mfc",
    MFC_SIZE);
318                         priv->mssync_mmap_base =
319                                 mapfileat(priv->fd_spe_dir, "mss",
    MSS_SIZE);
320                         priv->cntl_mmap_base =
321                                 mapfileat(priv->fd_spe_dir, "cntl",
    CNTL_SIZE);
322                         priv->signal1_mmap_base =
323                                 mapfileat(priv->fd_spe_dir, "signal1",
324                                                 SIGNAL_SIZE);
325                         priv->signal2_mmap_base =
326                                 mapfileat(priv->fd_spe_dir, "signal2",
327                                                 SIGNAL_SIZE);
328
329                         if (priv->mfc_mmap_base == MAP_FAILED ||
330                                         priv->cntl_mmap_base == MAP_FAILED ||
331                                         priv->signal1_mmap_base == MAP_FAILED ||
```

```
332                                     priv->signal2_mmap_base == MAP_FAILED) {
333                                 DEBUG_PRINTF("ERROR: Could not map SPE "
334                                              "PS memory.\n");
335                                 free_spe_context(spe);
336                                 errno = ENOMEM;
337                                 return NULL;
338                         }
339                 }
340         }
341
342         if (flags & SPE_CFG_SIGNOTIFY1_OR) {
343                 if (setsignotify(priv->fd_spe_dir, "signal1_type")) {
344                         DEBUG_PRINTF("ERROR: Could not open SPE "
345                                      "signal1_type file.\n");
346                         free_spe_context(spe);
347                         errno = EFAULT;
348                         return NULL;
349                 }
350         }
351
352         if (flags & SPE_CFG_SIGNOTIFY2_OR) {
353                 if (setsignotify(priv->fd_spe_dir, "signal2_type")) {
354                         DEBUG_PRINTF("ERROR: Could not open SPE "
355                                      "signal2_type file.\n");
356                         free_spe_context(spe);
357                         errno = EFAULT;
358                         return NULL;
359                 }
360         }
361
362         return spe;
363 }
```

Here is the call graph for this function:



int _base_spe_context_destroy (spe_context_ptr_t *spectx*)

_base_spe_context_destroy cleans up what is left when an SPE executable has exited. Closes open file handles and unmaps memory areas.

Parameters

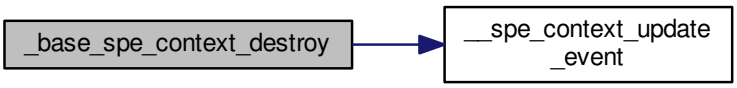
spectx	Specifies the SPE context

Definition at line 418 of file create.c.

References __spe_context_update_event().

```
419 {
420         int ret = free_spe_context(spe);
421
422         __spe_context_update_event();
423
424         return ret;
425 }
```

Here is the call graph for this function:



void _base_spe_context_lock (spe_context_ptr_t *spe*, enum fd_name *fd*)

_base_spe_context_lock locks members of the SPE context
Parameters

spectx	Specifies the SPE context
fd	Specifies the file

Definition at line 91 of file create.c.
References spe_context::base_private, and spe_context_base_priv::fd_lock.
Referenced by _base_spe_close_if_open(), and _base_spe_open_if_closed().

```
92 {
93         pthread_mutex_lock(&spe->base_private->fd_lock[fdesc]);
94 }
```

void _base_spe_context_unlock (spe_context_ptr_t *spe*, enum fd_name *fd*)

_base_spe_context_unlock unlocks members of the SPE context
Parameters

spectx	Specifies the SPE context
fd	Specifies the file

Definition at line 96 of file create.c.
References spe_context::base_private, and spe_context_base_priv::fd_lock.
Referenced by _base_spe_close_if_open(), and _base_spe_open_if_closed().

```
97 {
98         pthread_mutex_unlock(&spe->base_private->fd_lock[fdesc]);
99 }
```

spe_gang_context_ptr_t _base_spe_gang_context_create (unsigned int *flags*)

creates the directory in SPUFS that will contain all SPEs that are considered a gang Note: I would like to generalize this to a ”group” or ”set” Additional attributes maintained at the group level should be used to define scheduling constraints such ”temporal” (e.g., scheduled all at the same time, i.e., a gang) ”topology” (e.g., ”closeness” of SPEs for optimal communication)

Definition at line 376 of file create.c.
References spe_gang_context::base_private, DEBUG_PRINTF, and spe_gang_context_base_priv::gangname.

```
377 {
378         char pathname[256];
379         struct spe_gang_context_base_priv *pgctx = NULL;
380         struct spe_gang_context *gctx = NULL;
381
```

```
382         gctx = malloc(sizeof(*gctx));
383         if (!gctx) {
384                 DEBUG_PRINTF("ERROR: Could not allocate spe context.\n");
385                 return NULL;
386         }
387         memset(gctx, 0, sizeof(*gctx));
388
389         pgctx = malloc(sizeof(*pgctx));
390         if (!pgctx) {
391                 DEBUG_PRINTF("ERROR: Could not allocate spe context.\n");
392                 free(gctx);
393                 return NULL;
394         }
395         memset(pgctx, 0, sizeof(*pgctx));
396
397         gctx->base_private = pgctx;
398
399         sprintf(gctx->base_private->gangname, "gang-%i-%lu", getpid(),
400                         (unsigned long)gctx);
401         sprintf(pathname, "/spu/%s", gctx->base_private->gangname);
402
403         gctx->base_private->fd_gang_dir = spu_create(pathname, SPU_CREATE_GANG,
404                                 S_IRUSR | S_IWUSR | S_IXUSR);
405
406         if (gctx->base_private->fd_gang_dir < 0) {
407                 DEBUG_PRINTF("ERROR: Could not create Gang %s\n", pathname);
408                 free_spe_gang_context(gctx);
409                 errno = EFAULT;
410                 return NULL;
411         }
412
413         gctx->base_private->flags = flags;
414
415         return gctx;
416 }
```

int _base_spe_gang_context_destroy (spe_gang_context_ptr_t *gctx*)

_base_spe_gang_context_destroy destroys a gang context and frees associated resources

Parameters

gctx	Specifies the SPE gang context

Definition at line 427 of file create.c.

```
428 {
429         return free_spe_gang_context(gctx);
430 }
```

int _base_spe_open_if_closed (struct spe_context * *spe*, enum fd_name *fdesc*, int *locked*)

Definition at line 101 of file create.c.

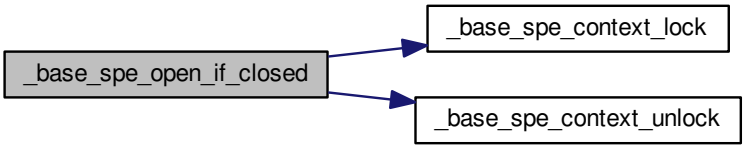
References _base_spe_context_lock(), _base_spe_context_unlock(), spe_context::base_private, spe_context-_base_priv::fd_spe_dir, fd_attr::mode, fd_attr::name, spe_context_base_priv::spe_fds_array, and spe_context-_base_priv::spe_fds_refcount.

Referenced by __base_spe_event_source_acquire(), _base_spe_in_mbox_status(), _base_spe_in_mbox_write(), _base_spe_mssync_start(), _base_spe_mssync_status(), _base_spe_out_intr_mbox_read(), _base_spe_out_intr_-mbox_status(), _base_spe_out_mbox_read(), _base_spe_out_mbox_status(), and _base_spe_signal_write().

```
102 {
103         if (!locked)
104                 _base_spe_context_lock(spe, fdesc);
105
106         /* already open? */
107         if (spe->base_private->spe_fds_array[fdesc] != -1) {
108                 spe->base_private->spe_fds_refcount[fdesc]++;
109         } else {
110                 spe->base_private->spe_fds_array[fdesc] =
111                         openat(spe->base_private->fd_spe_dir,
112                                         spe_fd_attr[fdesc].name,
```

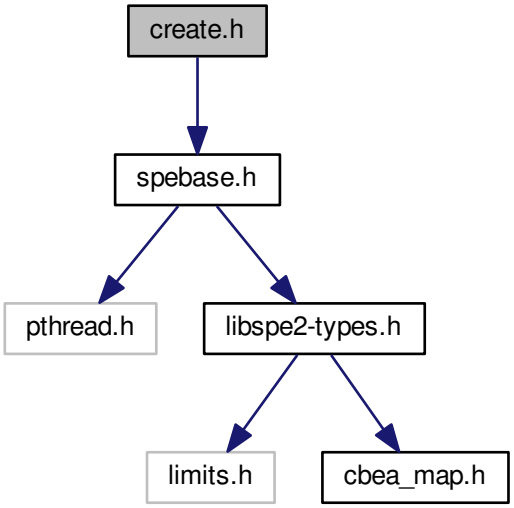
```
113                                     spe_fd_attr[fdesc].mode);
114
115                 if (spe->base_private->spe_fds_array[(int)fdesc] > 0)
116                         spe->base_private->spe_fds_refcount[(int)fdesc]++;
117         }
118
119         if (!locked)
120                 _base_spe_context_unlock(spe, fdesc);
121
122         return spe->base_private->spe_fds_array[(int)fdesc];
123 }
```

Here is the call graph for this function:

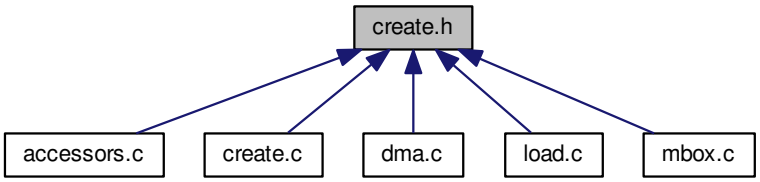


3.4 create.h File Reference

`#include "spebase.h"`
Include dependency graph for create.h:



This graph shows which files directly or indirectly include this file:



Functions

- int _base_spe_open_if_closed (struct spe_context *spe, enum fd_name fdesc, int locked)
- void _base_spe_close_if_open (struct spe_context *spe, enum fd_name fdesc)

3.4.1 Function Documentation

void _base_spe_close_if_open (struct spe_context * *spe*, enum fd_name *fdesc*)

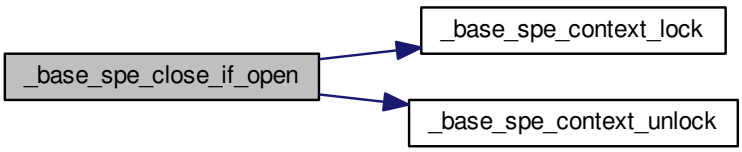
Definition at line 125 of file create.c.

References _base_spe_context_lock(), _base_spe_context_unlock(), spe_context::base_private, spe_context_base_priv::spe_fds_array, and spe_context_base_priv::spe_fds_refcount.

Referenced by __base_spe_event_source_release(), and _base_spe_signal_write().

```
126 {
127         _base_spe_context_lock(spe, fdesc);
128 
129         if (spe->base_private->spe_fds_array[(int)fdesc] != -1 &&
130                 spe->base_private->spe_fds_refcount[(int)fdesc] == 1) {
131 
132                 spe->base_private->spe_fds_refcount[(int)fdesc]--;
133                 close(spe->base_private->spe_fds_array[(int)fdesc]);
134 
135                 spe->base_private->spe_fds_array[(int)fdesc] = -1;
136         } else if (spe->base_private->spe_fds_refcount[(int)fdesc] > 0) {
137                 spe->base_private->spe_fds_refcount[(int)fdesc]--;
138         }
139 
140         _base_spe_context_unlock(spe, fdesc);
141 }
```

Here is the call graph for this function:



int _base_spe_open_if_closed (struct spe_context * *spe*, enum fd_name *fdesc*, int *locked*)

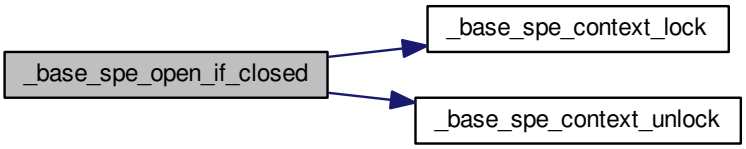
Definition at line 101 of file create.c.

References _base_spe_context_lock(), _base_spe_context_unlock(), spe_context::base_private, spe_context-_base_priv::fd_spe_dir, fd_attr::mode, fd_attr::name, spe_context_base_priv::spe_fds_array, and spe_context-_base_priv::spe_fds_refcount.

Referenced by __base_spe_event_source_acquire(), _base_spe_in_mbox_status(), _base_spe_in_mbox_write(), _base_spe_mssync_start(), _base_spe_mssync_status(), _base_spe_out_intr_mbox_read(), _base_spe_out_intr_-mbox_status(), _base_spe_out_mbox_read(), _base_spe_out_mbox_status(), and _base_spe_signal_write().

```
102 {
103         if (!locked)
104                 _base_spe_context_lock(spe, fdesc);
105
106         /* already open? */
107         if (spe->base_private->spe_fds_array[fdesc] != -1) {
108                 spe->base_private->spe_fds_refcount[fdesc]++;
109         } else {
110                 spe->base_private->spe_fds_array[fdesc] =
111                         openat(spe->base_private->fd_spe_dir,
112                                         spe_fd_attr[fdesc].name,
113                                         spe_fd_attr[fdesc].mode);
114
115                 if (spe->base_private->spe_fds_array[(int)fdesc] > 0)
116                         spe->base_private->spe_fds_refcount[(int)fdesc]++;
117         }
118
119         if (!locked)
120                 _base_spe_context_unlock(spe, fdesc);
121
122         return spe->base_private->spe_fds_array[(int)fdesc];
123 }
```

Here is the call graph for this function:

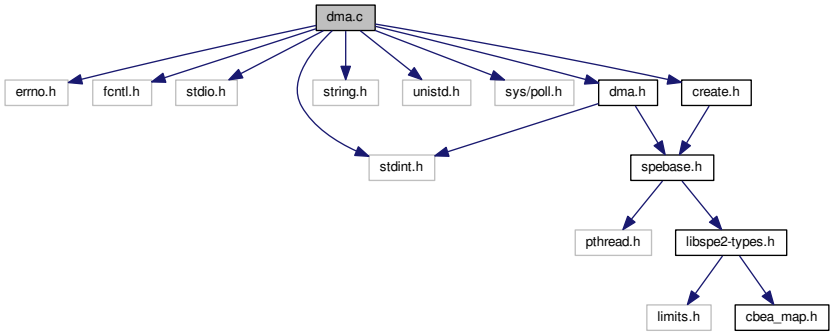


3.5 design.txt File Reference

3.6 dma.c File Reference

```
#include <errno.h>
#include <fcntl.h>
#include <stdio.h>
#include <stdint.h>
#include <string.h>
#include <unistd.h>
#include <sys/poll.h>
#include "create.h"
#include "dma.h"
```

Include dependency graph for dma.c:



Functions

- int _base_spe_mfcio_put (spe_context_ptr_t spectx, unsigned int ls, void *ea, unsigned int size, unsigned int tag, unsigned int tid, unsigned int rid)
- int _base_spe_mfcio_putb (spe_context_ptr_t spectx, unsigned int ls, void *ea, unsigned int size, unsigned int tag, unsigned int tid, unsigned int rid)
- int _base_spe_mfcio_putf (spe_context_ptr_t spectx, unsigned int ls, void *ea, unsigned int size, unsigned int tag, unsigned int tid, unsigned int rid)
- int _base_spe_mfcio_get (spe_context_ptr_t spectx, unsigned int ls, void *ea, unsigned int size, unsigned int tag, unsigned int tid, unsigned int rid)
- int _base_spe_mfcio_getb (spe_context_ptr_t spectx, unsigned int ls, void *ea, unsigned int size, unsigned int tag, unsigned int tid, unsigned int rid)
- int _base_spe_mfcio_getf (spe_context_ptr_t spectx, unsigned int ls, void *ea, unsigned int size, unsigned int tag, unsigned int tid, unsigned int rid)
- int _base_spe_mfcio_tag_status_read (spe_context_ptr_t spectx, unsigned int mask, unsigned int behavior, unsigned int *tag_status)
- int _base_spe_mssync_start (spe_context_ptr_t spectx)
- int _base_spe_mssync_status (spe_context_ptr_t spectx)

3.6.1 Function Documentation

int _base_spe_mfcio_get (spe_context_ptr_t *spectx*, unsigned int *ls*, void * *ea*, unsigned int *size*, unsigned int *tag*, unsigned int *tid*, unsigned int *rid*)

The _base_spe_mfcio_get function places a get DMA command on the proxy command queue of the SPE thread specified by speid. The get command transfers size bytes of data starting at the effective address specified by ea to the local store address specified by ls. The DMA is identified by the tag id specified by tag and performed according to the transfer class and replacement class specified by tid and rid respectively.

Parameters

spectx	Specifies the SPE context
ls	Specifies the starting local store destination address.

ea	Specifies the starting effective address source address.
size	Specifies the size, in bytes, to be transferred.
tag	Specifies the tag id used to identify the DMA command.
tid	Specifies the transfer class identifier of the DMA command.
rid	Specifies the replacement class identifier of the DMA command.

Returns

On success, return 0. On failure, -1 is returned.

Definition at line 160 of file dma.c.
References MFC_CMD_GET.

```
167 {
168         return spe_do_mfc_get(spectx, ls, ea, size, tag, tid, rid, MFC_CMD_GET);
169 }
```

int _base_spe_mfcio_getb (spe_context_ptr_t *spectx*, unsigned int *ls*, void * *ea*, unsigned int *size*, unsigned int *tag*, unsigned int *tid*, unsigned int *rid*)

The _base_spe_mfcio_getb function is identical to _base_spe_mfcio_get except that it places a getb (get with barrier) DMA command on the proxy command queue. The barrier form ensures that this command and all sequence commands with the same tag identifier as this command are locally ordered with respect to all previously issued commands with the same tag group and command queue.
Parameters

spectx	Specifies the SPE context
ls	Specifies the starting local store destination address.
ea	Specifies the starting effective address source address.
size	Specifies the size, in bytes, to be transferred.
tag	Specifies the tag id used to identify the DMA command.
tid	Specifies the transfer class identifier of the DMA command.
rid	Specifies the replacement class identifier of the DMA command.

Returns

On success, return 0. On failure, -1 is returned.

Definition at line 171 of file dma.c.
References MFC_CMD_GETB.

```
178 {
179         return spe_do_mfc_get(spectx, ls, ea, size, tag, rid, rid, MFC_CMD_GETB);
180 }
```

int _base_spe_mfcio_getf (spe_context_ptr_t *spectx*, unsigned int *ls*, void * *ea*, unsigned int *size*, unsigned int *tag*, unsigned int *tid*, unsigned int *rid*)

The _base_spe_mfcio_getf function is identical to _base_spe_mfcio_get except that it places a getf (get with fence) DMA command on the proxy command queue. The fence form ensure that this command is locally ordered with respect to all previously issued commands with the same tag group and command queue.

Parameters

spectx	Specifies the SPE context
ls	Specifies the starting local store destination address.
ea	Specifies the starting effective address source address.
size	Specifies the size, in bytes, to be transferred.
tag	Specifies the tag id used to identify the DMA command.
tid	Specifies the transfer class identifier of the DMA command.
rid	Specifies the replacement class identifier of the DMA command.

Returns

On success, return 0. On failure, -1 is returned.

Definition at line 182 of file dma.c.
References MFC_CMD_GETF.

```
189 {
190         return spe_do_mfc_get(spectx, ls, ea, size, tag, tid, rid, MFC_CMD_GETF);
191 }
```

int _base_spe_mfcio_put (spe_context_ptr_t *spectx*, unsigned int *ls*, void * *ea*, unsigned int *size*, unsigned int *tag*, unsigned int *tid*, unsigned int *rid*)

The _base_spe_mfcio_put function places a put DMA command on the proxy command queue of the SPE thread specified by speid. The put command transfers size bytes of data starting at the local store address specified by ls to the effective address specified by ea. The DMA is identified by the tag id specified by tag and performed according transfer class and replacement class specified by tid and rid respectively.
Parameters

spectx	Specifies the SPE context
ls	Specifies the starting local store destination address.
ea	Specifies the starting effective address source address.
size	Specifies the size, in bytes, to be transferred.
tag	Specifies the tag id used to identify the DMA command.
tid	Specifies the transfer class identifier of the DMA command.
rid	Specifies the replacement class identifier of the DMA command.

Returns

On success, return 0. On failure, -1 is returned.

Definition at line 126 of file dma.c.
References MFC_CMD_PUT.

```
133 {
134         return spe_do_mfc_put(spectx, ls, ea, size, tag, tid, rid, MFC_CMD_PUT);
135 }
```

int _base_spe_mfcio_putb (spe_context_ptr_t *spectx*, unsigned int *ls*, void * *ea*, unsigned int *size*, unsigned int *tag*, unsigned int *tid*, unsigned int *rid*)

The _base_spe_mfcio_putb function is identical to _base_spe_mfcio_put except that it places a putb (put with barrier) DMA command on the proxy command queue. The barrier form ensures that this command and all sequence commands with the same tag identifier as this command are locally ordered with respect to all previously i ssued commands with the same tag group and command queue.

Parameters

spectx	Specifies the SPE context
ls	Specifies the starting local store destination address.
ea	Specifies the starting effective address source address.
size	Specifies the size, in bytes, to be transferred.
tag	Specifies the tag id used to identify the DMA command.
tid	Specifies the transfer class identifier of the DMA command.
rid	Specifies the replacement class identifier of the DMA command.

Returns

On success, return 0. On failure, -1 is returned.

Definition at line 137 of file dma.c.
References MFC_CMD_PUTB.

```
144 {
145         return spe_do_mfc_put(spectx, ls, ea, size, tag, tid, rid, MFC_CMD_PUTB);
146 }
```

int _base_spe_mfcio_putf (spe_context_ptr_t *spectx*, unsigned int *ls*, void * *ea*, unsigned int *size*, unsigned int *tag*, unsigned int *tid*, unsigned int *rid*)

The _base_spe_mfcio_putf function is identical to _base_spe_mfcio_put except that it places a putf (put with fence) DMA command on the proxy command queue. The fence form ensures that this command is locally ordered with respect to all previously issued commands with the same tag group and command queue.
Parameters

spectx	Specifies the SPE context
ls	Specifies the starting local store destination address.
ea	Specifies the starting effective address source address.
size	Specifies the size, in bytes, to be transferred.
tag	Specifies the tag id used to identify the DMA command.
tid	Specifies the transfer class identifier of the DMA command.
rid	Specifies the replacement class identifier of the DMA command.

Returns

On success, return 0. On failure, -1 is returned.

Definition at line 148 of file dma.c.
References MFC_CMD_PUTF.

```
155 {
156         return spe_do_mfc_put(spectx, ls, ea, size, tag, tid, rid, MFC_CMD_PUTF);
157 }
```

int _base_spe_mfcio_tag_status_read (spe_context_ptr_t *spectx*, unsigned int *mask*, unsigned int *behavior*, unsigned int * *tag_status*)

_base_spe_mfcio_tag_status_read
No Idea
Definition at line 307 of file dma.c.
References spe_context_base_priv::active_tagmask, spe_context::base_private, spe_context_base_priv::flags, SPE_MAP_PS, SPE_TAG_ALL, SPE_TAG_ANY, and SPE_TAG_IMMEDIATE.

```
308 {
309         if ( mask != 0 ) {
310                 if (!(spectx->base_private->flags & SPE_MAP_PS))
311                         mask = 0;
312         } else {
313                 if ((spectx->base_private->flags & SPE_MAP_PS))
314                         mask = spectx->base_private->active_tagmask;
315         }
316
317         if (!tag_status) {
318                 errno = EINVAL;
319                 return -1;
320         }
321
322         switch (behavior) {
323         case SPE_TAG_ALL:
324                 return spe_mfcio_tag_status_read_all(spectx, mask, tag_status);
325         case SPE_TAG_ANY:
326                 return spe_mfcio_tag_status_read_any(spectx, mask, tag_status);
327         case SPE_TAG_IMMEDIATE:
328                 return spe_mfcio_tag_status_read_immediate(spectx, mask, tag_status);
329         default:
330                 errno = EINVAL;
331                 return -1;
332         }
333 }
```

int _base_spe_mssync_start (spe_context_ptr_t *spectx*)

_base_spe_mssync_start starts Multisource Synchronisation

Parameters

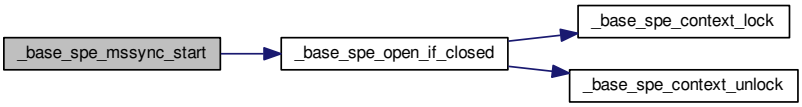
spectx	Specifies the SPE context

Definition at line 335 of file dma.c.

References _base_spe_open_if_closed(), spe_context::base_private, FD_MSS, spe_context_base_priv::flags, spe_mssync_area::MFC_MSSync, spe_context_base_priv::mssync_mmap_base, and SPE_MAP_PS.

```
336 {
337         int ret, fd;
338         unsigned int data = 1; /* Any value can be written here */
339
340         volatile struct spe_mssync_area *mss_area =
341                 spectx->base_private->mssync_mmap_base;
342
343         if (spectx->base_private->flags & SPE_MAP_PS) {
344                 mss_area->MFC_MSSync = data;
345                 return 0;
346         } else {
347                 fd = _base_spe_open_if_closed(spectx,
    FD_MSS, 0);
348                 if (fd != -1) {
349                         ret = write(fd, &data, sizeof (data));
350                         if ((ret < 0) && (errno != EIO)) {
351                                 perror("spe_mssync_start: internal error");
352                         }
353                         return ret < 0 ? -1 : 0;
354                 } else
355                         return -1;
356         }
357 }
```

Here is the call graph for this function:



int _base_spe_mssync_status (spe_context_ptr_t *spectx*)

_base_spe_mssync_status retrieves status of Multisource Synchronisation
Parameters

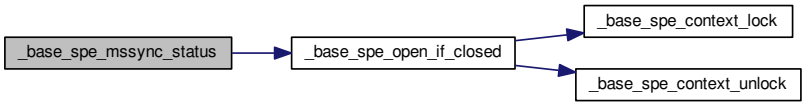
spectx	Specifies the SPE context

Definition at line 359 of file dma.c.

References _base_spe_open_if_closed(), spe_context::base_private, FD_MSS, spe_context_base_priv::flags, spe_mssync_area::MFC_MSSync, spe_context_base_priv::mssync_mmap_base, and SPE_MAP_PS.

```
360 {
361         int ret, fd;
362         unsigned int data;
363
364         volatile struct spe_mssync_area *mss_area =
365                 spectx->base_private->mssync_mmap_base;
366
367         if (spectx->base_private->flags & SPE_MAP_PS) {
368                 return  mss_area->MFC_MSSync;
369         } else {
370                 fd = _base_spe_open_if_closed(spectx,
    FD_MSS, 0);
371                 if (fd != -1) {
372                         ret = read(fd, &data, sizeof (data));
373                         if ((ret < 0) && (errno != EIO)) {
374                                 perror("spe_mssync_start: internal error");
375                         }
376                         return ret < 0 ? -1 : data;
377                 } else
378                         return -1;
379         }
380 }
```

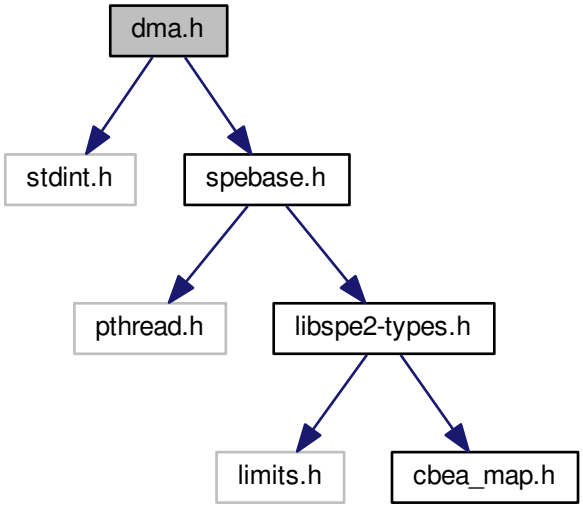
Here is the call graph for this function:



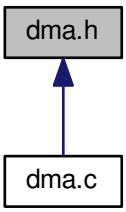
3.7 dma.h File Reference

```
#include <stdint.h>
#include "spebase.h"
```

Include dependency graph for dma.h:



This graph shows which files directly or indirectly include this file:



Data Structures

- struct mfc_command_parameter_area

Enumerations

- enum mfc_cmd {
  MFC_CMD_PUT = 0x20, MFC_CMD_PUTB = 0x21, MFC_CMD_PUTF = 0x22, MFC_CMD_GET = 0x40,
  MFC_CMD_GETB = 0x41, MFC_CMD_GETF = 0x42 }

3.7.1 Enumeration Type Documentation

enum mfc_cmd

Enumerator

MFC_CMD_PUT
MFC_CMD_PUTB
MFC_CMD_PUTF
MFC_CMD_GET
MFC_CMD_GETB
MFC_CMD_GETF

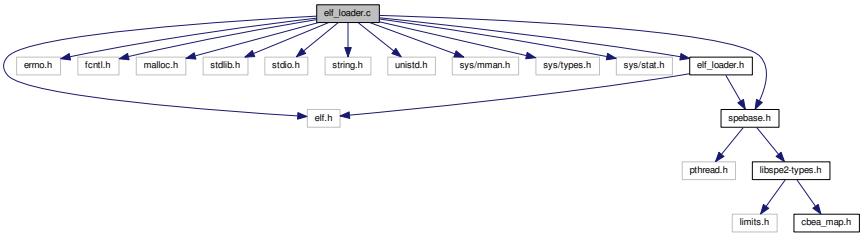
Definition at line 37 of file dma.h.

```
37             {
38         MFC_CMD_PUT  = 0x20,
39         MFC_CMD_PUTB = 0x21,
40         MFC_CMD_PUTF = 0x22,
41         MFC_CMD_GET  = 0x40,
42         MFC_CMD_GETB = 0x41,
43         MFC_CMD_GETF = 0x42,
44 };
```

3.8 elf_loader.c File Reference

```
#include <elf.h>
#include <errno.h>
#include <fcntl.h>
#include <malloc.h>
#include <stdlib.h>
#include <stdio.h>
#include <string.h>
#include <unistd.h>
#include <sys/mman.h>
#include <sys/types.h>
#include <sys/stat.h>
#include "elf_loader.h"
#include "spebase.h"
```

Include dependency graph for elf_loader.c:



Macros

- #define __PRINTF(fmt, args...) { fprintf(stderr,fmt , ## args); }
- #define DEBUG_PRINTF(fmt, args...)
- #define TAG

Functions

- int _base_spe_verify_spe_elf_image (spe_program_handle_t *handle)
- int _base_spe_parse_isolated_elf (spe_program_handle_t *handle, uint64_t *addr, uint32_t *size)
- int _base_spe_load_spe_elf (spe_program_handle_t *handle, void *ld_buffer, struct spe_ld_info *ld_info)
- int _base_spe_toe_ear (spe_program_handle_t *speh)

3.8.1 Macro Definition Documentation

#define __PRINTF(*fmt, args...*) { fprintf(stderr,fmt , ## args); }

Definition at line 40 of file elf_loader.c.

#define DEBUG_PRINTF(*fmt, args...*)

Definition at line 45 of file elf_loader.c.

Referenced by _base_spe_context_create(), _base_spe_context_run(), _base_spe_count_physical_cpus(), _base_spe_count_physical_spes(), _base_spe_gang_context_create(), _base_spe_handle_library_callback(), _base_spe_load_spe_elf(), _base_spe_out_mbox_read(), _base_spe_parse_isolated_elf(), _base_spe_program_load(), and _base_spe_program_load_complete().

#define TAG

Definition at line 46 of file elf_loader.c.

3.8.2 Function Documentation

int _base_spe_load_spe_elf (spe_program_handle_t * *handle*, void * *ld_buffer*, struct spe_ld_info * *ld_info*)

Definition at line 201 of file elf_loader.c.

References DEBUG_PRINTF, spe_program_handle::elf_image, and spe_ld_info::entry.

Referenced by _base_spe_program_load().

```
202 {
203         Elf32_Ehdr *ehdr;
204         Elf32_Phdr *phdr;
205         Elf32_Phdr *ph, *prev_ph;
206 
207         Elf32_Shdr *shdr;
208         Elf32_Shdr *sh;
209 
210         Elf32_Off  toe_addr = 0;
211         long    toe_size = 0;
212 
213         char* str_table = 0;
214 
215         int num_load_seg = 0;
216         void *elf_start;
217         int ret;
218 
219         DEBUG_PRINTF ("load_spe_elf(%p, %p)\n", handle, ld_buffer);
220 
221         elf_start = handle->elf_image;
222 
223         DEBUG_PRINTF ("load_spe_elf(%p, %p)\n", handle->elf_image, ld_buffer);
224         ehdr = (Elf32_Ehdr *)(handle->elf_image);
225 
226         /* Check for a Valid SPE ELF Image (again) */
227         if ((ret=check_spe_elf(ehdr)))
228                 return ret;
229 
230         /* Start processing headers */
231         phdr = (Elf32_Phdr *) ((char *) ehdr + ehdr->e_phoff);
232         shdr = (Elf32_Shdr *) ((char *) ehdr + ehdr->e_shoff);
```

```
233         str_table = (char*)ehdr + shdr[ehdr->e_shstrndx].sh_offset;
234
235         /* traverse the sections to locate the toe segment */
236         /* by specification, the toe sections are grouped together in a segment */
237         for (sh = shdr; sh < &shdr[ehdr->e_shnum]; ++sh)
238         {
239                 DEBUG_PRINTF("section name: %s ( start: 0x%04x, size: 0x%04x)\n", str_table+sh
    ->sh_name, sh->sh_offset, sh->sh_size );
240                 if (strcmp(".toe", str_table+sh->sh_name) == 0) {
241                         DEBUG_PRINTF("section offset: %d\n", sh->sh_offset);
242                         toe_size += sh->sh_size;
243                         if ((toe_addr == 0) || (toe_addr > sh->sh_addr))
244                                 toe_addr = sh->sh_addr;
245                 }
246                 /* Disabled : Actually not needed, only good for testing
247                 if (strcmp(".bss", str_table+sh->sh_name) == 0) {
248                         DEBUG_PRINTF("zeroing .bss section:\n");
249                         DEBUG_PRINTF("section offset: 0x%04x\n", sh->sh_offset);
250                         DEBUG_PRINTF("section size: 0x%04x\n", sh->sh_size);
251                         memset(ld_buffer + sh->sh_offset, 0, sh->sh_size);
252                 }  */
253
254 #ifdef DEBUG
255                 if (strcmp(".note.spu_name", str_table+sh->sh_name) == 0)
256                         display_debug_output(elf_start, sh);
257 #endif /*DEBUG*/
258         }
259
260         /*
261          * Load all PT_LOAD segments onto the SPE local store buffer.
262          */
263         DEBUG_PRINTF("Segments: 0x%x\n", ehdr->e_phnum);
264         for (ph = phdr, prev_ph = NULL; ph < &phdr[ehdr->e_phnum]; ++ph) {
265                 switch (ph->p_type) {
266                 case PT_LOAD:
267                         if (!overlay(ph, prev_ph)) {
268                                 if (ph->p_filesz < ph->p_memsz) {
269                                         DEBUG_PRINTF("padding loaded image with zeros:\n");
270                                         DEBUG_PRINTF("start: 0x%04x\n", ph->p_vaddr + ph->
    p_filesz);
271                                         DEBUG_PRINTF("length: 0x%04x\n", ph->p_memsz - ph->
    p_filesz);
272                                         memset(ld_buffer + ph->p_vaddr + ph->p_filesz, 0, ph->p_memsz - ph
    ->p_filesz);
273                                 }
274                                 copy_to_ld_buffer(handle, ld_buffer, ph,
275                                                   toe_addr, toe_size);
276                                 num_load_seg++;
277                         }
278                         break;
279                 case PT_NOTE:
280                         DEBUG_PRINTF("SPE_LOAD found PT_NOTE\n");
281                         break;
282                 }
283         }
284         if (num_load_seg == 0)
285           {
286                   DEBUG_PRINTF ("no segments to load");
287                   errno = EINVAL;
288                   return -errno;
289           }
290
291         /* Remember where the code wants to be started */
292         ld_info->entry = ehdr->e_entry;
293         DEBUG_PRINTF ("entry = 0x%x\n", ehdr->e_entry);
294
295         return 0;
296
297 }
```

int _base_spe_parse_isolated_elf (spe_program_handle_t * *handle*, uint64_t * *addr*, uint32_t * *size*)

Definition at line 111 of file elf_loader.c.

References DEBUG_PRINTF, and spe_program_handle::elf_image.

```
113 {
114         Elf32_Ehdr *ehdr = (Elf32_Ehdr *)handle->elf_image;
```

```
115         Elf32_Phdr *phdr;
116
117         if (!ehdr) {
118                 DEBUG_PRINTF("No ELF image has been loaded\n");
119                 errno = EINVAL;
120                 return -errno;
121         }
122
123         if (ehdr->e_phentsize != sizeof(*phdr)) {
124                 DEBUG_PRINTF("Invalid program header format (phdr size=%d)\n",
125                                 ehdr->e_phentsize);
126                 errno = EINVAL;
127                 return -errno;
128         }
129
130         if (ehdr->e_phnum != 1) {
131                 DEBUG_PRINTF("Invalid program header count (%d), expected 1\n",
132                                 ehdr->e_phnum);
133                 errno = EINVAL;
134                 return -errno;
135         }
136
137         phdr = (Elf32_Phdr *)(handle->elf_image + ehdr->e_phoff);
138
139         if (phdr->p_type != PT_LOAD || phdr->p_memsz == 0) {
140                 DEBUG_PRINTF("SPE program segment is not loadable (type=%x)\n",
141                                 phdr->p_type);
142                 errno = EINVAL;
143                 return -errno;
144         }
145
146         if (addr)
147                 *addr = (uint64_t)(unsigned long)
148                         (handle->elf_image + phdr->p_offset);
149
150         if (size)
151                 *size = phdr->p_memsz;
152
153         return 0;
154 }
```

int _base_spe_toe_ear (spe_program_handle_t * *speh*)

Definition at line 354 of file elf_loader.c.

References spe_program_handle::elf_image, and spe_program_handle::toe_shadow.

Referenced by _base_spe_image_open().

```
355 {
356         Elf32_Ehdr *ehdr;
357         Elf32_Shdr *shdr, *sh;
358         char *str_table;
359         char **ch;
360         int ret;
361         long toe_size;
362
363         ehdr = (Elf32_Ehdr*) (speh->elf_image);
364         shdr = (Elf32_Shdr*) ((char*) ehdr + ehdr->e_shoff);
365         str_table = (char*)ehdr + shdr[ehdr->e_shstrndx].sh_offset;
366
367         toe_size = 0;
368         for (sh = shdr; sh < &shdr[ehdr->e_shnum]; ++sh)
369                 if (strcmp(".toe", str_table + sh->sh_name) == 0)
370                         toe_size += sh->sh_size;
371
372         ret = 0;
373         if (toe_size > 0) {
374                 for (sh = shdr; sh < &shdr[ehdr->e_shnum]; ++sh)
375                         if (sh->sh_type == SHT_SYMTAB || sh->sh_type ==
376                             SHT_DYNSYM)
377                                 ret = toe_check_syms(ehdr, sh);
378                 if (!ret && toe_size != 16) {
379                         /* Paranoia */
380                         fprintf(stderr, "Unexpected toe size of %ld\n",
381                                 toe_size);
382                         errno = EINVAL;
383                         ret = 1;
```

```
384                 }
385         }
386         if (!ret && toe_size) {
387                 /*
388                  * Allocate toe_shadow, and fill it with elf_image.
389                  */
390                 speh->toe_shadow = malloc(toe_size);
391                 if (speh->toe_shadow) {
392                         ch = (char**) speh->toe_shadow;
393                         if (sizeof(char*) == 8) {
394                                 ch[0] = (char*) speh->elf_image;
395                                 ch[1] = 0;
396                         } else {
397                                 ch[0] = 0;
398                                 ch[1] = (char*) speh->elf_image;
399                                 ch[2] = 0;
400                                 ch[3] = 0;
401                         }
402                 } else {
403                         errno = ENOMEM;
404                         ret = 1;
405                 }
406         }
407         return ret;
408 }
```

int _base_spe_verify_spe_elf_image (spe_program_handle_t * *handle*)

verifies integrity of an SPE image

Definition at line 99 of file elf_loader.c.

References spe_program_handle::elf_image.

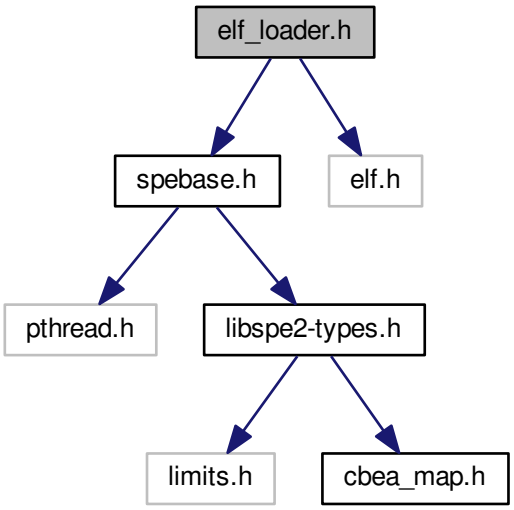
Referenced by _base_spe_emulated_loader_present(), and _base_spe_image_open().

```
100 {
101         Elf32_Ehdr *ehdr;
102         void *elf_start;
103
104         elf_start = handle->elf_image;
105         ehdr = (Elf32_Ehdr *)(handle->elf_image);
106
107         return check_spe_elf(ehdr);
108 }
```

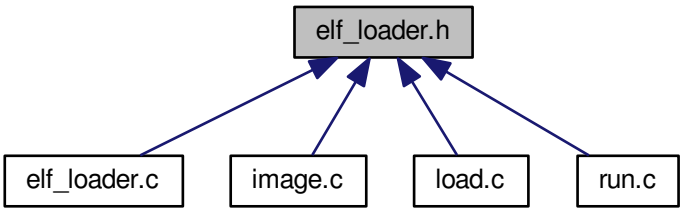
3.9 elf_loader.h File Reference

```
#include "spebase.h"
#include <elf.h>
```

Include dependency graph for elf_loader.h:



This graph shows which files directly or indirectly include this file:



Data Structures

- union addr64
- struct spe_ld_info

Macros

- #define LS_SIZE 0x40000 /∗ 256K (in bytes) ∗/
- #define SPE_LDR_PROG_start (LS_SIZE - 512)
- #define SPE_LDR_PARAMS_start (LS_SIZE - 128)

Functions

- int _base_spe_verify_spe_elf_image (spe_program_handle_t *handle)
- int _base_spe_load_spe_elf (spe_program_handle_t *handle, void *ld_buffer, struct spe_ld_info *ld_info)
- int _base_spe_parse_isolated_elf (spe_program_handle_t *handle, uint64_t *addr, uint32_t *size)
- int _base_spe_toe_ear (spe_program_handle_t *speh)

3.9.1 Macro Definition Documentation

#define LS_SIZE 0x40000 /* 256K (in bytes) */

Definition at line 23 of file elf_loader.h.
Referenced by _base_spe_context_create(), _base_spe_context_run(), and _base_spe_ls_size_get().

#define SPE_LDR_PARAMS_start (LS_SIZE - 128)

Definition at line 26 of file elf_loader.h.

#define SPE_LDR_PROG_start (LS_SIZE - 512)

Definition at line 25 of file elf_loader.h.

3.9.2 Function Documentation

int _base_spe_load_spe_elf (spe_program_handle_t * *handle*, void * *ld_buffer*, struct spe_ld_info * *ld_info*)

Definition at line 201 of file elf_loader.c.
References DEBUG_PRINTF, spe_program_handle::elf_image, and spe_ld_info::entry.
Referenced by _base_spe_program_load().

```
202 {
203         Elf32_Ehdr *ehdr;
204         Elf32_Phdr *phdr;
205         Elf32_Phdr *ph, *prev_ph;
206 
207         Elf32_Shdr *shdr;
208         Elf32_Shdr *sh;
209 
210         Elf32_Off  toe_addr = 0;
211         long    toe_size = 0;
212 
213         char* str_table = 0;
214 
215         int num_load_seg = 0;
216         void *elf_start;
217         int ret;
218 
219         DEBUG_PRINTF ("load_spe_elf(%p, %p)\n", handle, ld_buffer);
220 
221         elf_start = handle->elf_image;
222 
223         DEBUG_PRINTF ("load_spe_elf(%p, %p)\n", handle->elf_image, ld_buffer);
224         ehdr = (Elf32_Ehdr *)(handle->elf_image);
225 
226         /* Check for a Valid SPE ELF Image (again) */
227         if ((ret=check_spe_elf(ehdr)))
228                 return ret;
229 
230         /* Start processing headers */
231         phdr = (Elf32_Phdr *) ((char *) ehdr + ehdr->e_phoff);
232         shdr = (Elf32_Shdr *) ((char *) ehdr + ehdr->e_shoff);
233         str_table = (char*)ehdr + shdr[ehdr->e_shstrndx].sh_offset;
234 
235         /* traverse the sections to locate the toe segment */
236         /* by specification, the toe sections are grouped together in a segment */
```

```
237         for (sh = shdr; sh < &shdr[ehdr->e_shnum]; ++sh)
238         {
239                 DEBUG_PRINTF("section name: %s ( start: 0x%04x, size: 0x%04x)\n", str_table+sh
    ->sh_name, sh->sh_offset, sh->sh_size );
240                 if (strcmp(".toe", str_table+sh->sh_name) == 0) {
241                         DEBUG_PRINTF("section offset: %d\n", sh->sh_offset);
242                         toe_size += sh->sh_size;
243                         if ((toe_addr == 0) || (toe_addr > sh->sh_addr))
244                                 toe_addr = sh->sh_addr;
245                 }
246                 /* Disabled : Actually not needed, only good for testing
247                 if (strcmp(".bss", str_table+sh->sh_name) == 0) {
248                         DEBUG_PRINTF("zeroing .bss section:\n");
249                         DEBUG_PRINTF("section offset: 0x%04x\n", sh->sh_offset);
250                         DEBUG_PRINTF("section size: 0x%04x\n", sh->sh_size);
251                         memset(ld_buffer + sh->sh_offset, 0, sh->sh_size);
252                 }  */
253
254 #ifdef DEBUG
255                 if (strcmp(".note.spu_name", str_table+sh->sh_name) == 0)
256                         display_debug_output(elf_start, sh);
257 #endif /*DEBUG*/
258         }
259
260         /*
261          * Load all PT_LOAD segments onto the SPE local store buffer.
262          */
263         DEBUG_PRINTF("Segments: 0x%x\n", ehdr->e_phnum);
264         for (ph = phdr, prev_ph = NULL; ph < &phdr[ehdr->e_phnum]; ++ph) {
265                 switch (ph->p_type) {
266                 case PT_LOAD:
267                         if (!overlay(ph, prev_ph)) {
268                                 if (ph->p_filesz < ph->p_memsz) {
269                                         DEBUG_PRINTF("padding loaded image with zeros:\n");
270                                         DEBUG_PRINTF("start: 0x%04x\n", ph->p_vaddr + ph->
    p_filesz);
271                                         DEBUG_PRINTF("length: 0x%04x\n", ph->p_memsz - ph->
    p_filesz);
272                                         memset(ld_buffer + ph->p_vaddr + ph->p_filesz, 0, ph->p_memsz - ph
    ->p_filesz);
273                                 }
274                                 copy_to_ld_buffer(handle, ld_buffer, ph,
275                                                   toe_addr, toe_size);
276                                 num_load_seg++;
277                         }
278                         break;
279                 case PT_NOTE:
280                         DEBUG_PRINTF("SPE_LOAD found PT_NOTE\n");
281                         break;
282                 }
283         }
284         if (num_load_seg == 0)
285           {
286                   DEBUG_PRINTF ("no segments to load");
287                   errno = EINVAL;
288                   return -errno;
289           }
290
291         /* Remember where the code wants to be started */
292         ld_info->entry = ehdr->e_entry;
293         DEBUG_PRINTF ("entry = 0x%x\n", ehdr->e_entry);
294
295         return 0;
296
297 }
```

int _base_spe_parse_isolated_elf (spe_program_handle_t * *handle*, uint64_t * *addr*, uint32_t * *size*)

Definition at line 111 of file elf_loader.c.

References DEBUG_PRINTF, and spe_program_handle::elf_image.

```
113 {
114         Elf32_Ehdr *ehdr = (Elf32_Ehdr *)handle->elf_image;
115         Elf32_Phdr *phdr;
116
117         if (!ehdr) {
118                 DEBUG_PRINTF("No ELF image has been loaded\n");
```

```
119                 errno = EINVAL;
120                 return -errno;
121         }
122
123         if (ehdr->e_phentsize != sizeof(*phdr)) {
124                 DEBUG_PRINTF("Invalid program header format (phdr size=%d)\n",
125                              ehdr->e_phentsize);
126                 errno = EINVAL;
127                 return -errno;
128         }
129
130         if (ehdr->e_phnum != 1) {
131                 DEBUG_PRINTF("Invalid program header count (%d), expected 1\n",
132                              ehdr->e_phnum);
133                 errno = EINVAL;
134                 return -errno;
135         }
136
137         phdr = (Elf32_Phdr *)(handle->elf_image + ehdr->e_phoff);
138
139         if (phdr->p_type != PT_LOAD || phdr->p_memsz == 0) {
140                 DEBUG_PRINTF("SPE program segment is not loadable (type=%x)\n",
141                              phdr->p_type);
142                 errno = EINVAL;
143                 return -errno;
144         }
145
146         if (addr)
147                 *addr = (uint64_t)(unsigned long)
148                         (handle->elf_image + phdr->p_offset);
149
150         if (size)
151                 *size = phdr->p_memsz;
152
153         return 0;
154 }
```

int _base_spe_toe_ear (spe_program_handle_t * *speh*)

Definition at line 354 of file elf_loader.c.

References spe_program_handle::elf_image, and spe_program_handle::toe_shadow.

Referenced by _base_spe_image_open().

```
355 {
356         Elf32_Ehdr *ehdr;
357         Elf32_Shdr *shdr, *sh;
358         char *str_table;
359         char **ch;
360         int ret;
361         long toe_size;
362
363         ehdr = (Elf32_Ehdr*) (speh->elf_image);
364         shdr = (Elf32_Shdr*) ((char*) ehdr + ehdr->e_shoff);
365         str_table = (char*)ehdr + shdr[ehdr->e_shstrndx].sh_offset;
366
367         toe_size = 0;
368         for (sh = shdr; sh < &shdr[ehdr->e_shnum]; ++sh)
369                 if (strcmp(".toe", str_table + sh->sh_name) == 0)
370                         toe_size += sh->sh_size;
371
372         ret = 0;
373         if (toe_size > 0) {
374                 for (sh = shdr; sh < &shdr[ehdr->e_shnum]; ++sh)
375                         if (sh->sh_type == SHT_SYMTAB || sh->sh_type ==
376                             SHT_DYNSYM)
377                                 ret = toe_check_syms(ehdr, sh);
378                 if (!ret && toe_size != 16) {
379                         /* Paranoia */
380                         fprintf(stderr, "Unexpected toe size of %ld\n",
381                                 toe_size);
382                         errno = EINVAL;
383                         ret = 1;
384                 }
385         }
386         if (!ret && toe_size) {
387                 /*
```

```
388                  * Allocate toe_shadow, and fill it with elf_image.
389                  */
390                 speh->toe_shadow = malloc(toe_size);
391                 if (speh->toe_shadow) {
392                         ch = (char**) speh->toe_shadow;
393                         if (sizeof(char*) == 8) {
394                                 ch[0] = (char*) speh->elf_image;
395                                 ch[1] = 0;
396                         } else {
397                                 ch[0] = 0;
398                                 ch[1] = (char*) speh->elf_image;
399                                 ch[2] = 0;
400                                 ch[3] = 0;
401                         }
402                 } else {
403                         errno = ENOMEM;
404                         ret = 1;
405                 }
406         }
407         return ret;
408 }
```

int _base_spe_verify_spe_elf_image (spe_program_handle_t * *handle*)

verifies integrity of an SPE image

Definition at line 99 of file elf_loader.c.

References spe_program_handle::elf_image.

Referenced by _base_spe_emulated_loader_present(), and _base_spe_image_open().

```
100 {
101         Elf32_Ehdr *ehdr;
102         void *elf_start;
103
104         elf_start = handle->elf_image;
105         ehdr = (Elf32_Ehdr *)(handle->elf_image);
106
107         return check_spe_elf(ehdr);
108 }
```

3.10 handler_utils.h File Reference

Data Structures

- struct spe_reg128

Macros

- #define LS_SIZE 0x40000 /* 256K (in bytes) */
- #define LS_ADDR_MASK (LS_SIZE - 1)
- #define __PRINTF(fmt, args...) { fprintf(stderr,fmt , ## args); }
- #define DEBUG_PRINTF(fmt, args...)
- #define LS_ARG_ADDR(_index) (&((struct spe_reg128 *) ((char *) ls + ls_args))[_index])
- #define DECL_RET() struct spe_reg128 *ret = LS_ARG_ADDR(0)
- #define GET_LS_PTR(_off) (void *) ((char *) ls + ((_off) & LS_ADDR_MASK))
- #define GET_LS_PTR_NULL(_off) ((_off) ? GET_LS_PTR(_off) : NULL)
- #define DECL_0_ARGS() unsigned int ls_args = (opdata & 0xffffff)
- #define DECL_1_ARGS()
- #define DECL_2_ARGS()
- #define DECL_3_ARGS()
- #define DECL_4_ARGS()
- #define DECL_5_ARGS()
- #define DECL_6_ARGS()
- #define PUT_LS_RC(_a, _b, _c, _d)

3.10.1 Macro Definition Documentation

#define __PRINTF(*fmt, args...*) { fprintf(stderr,fmt , ## args); }

Definition at line 32 of file handler_utils.h.

#define DEBUG_PRINTF(*fmt, args...*)

Definition at line 36 of file handler_utils.h.

#define DECL_0_ARGS( ) unsigned int ls_args = (opdata & 0xffffff)

Definition at line 51 of file handler_utils.h.

#define DECL_1_ARGS( )

Value:

```
DECL_0_ARGS();                                          \
    struct spe_reg128 *arg0 = LS_ARG_ADDR(0)
```

Definition at line 54 of file handler_utils.h.

#define DECL_2_ARGS( )

Value:

```
DECL_1_ARGS();                                          \
    struct spe_reg128 *arg1 = LS_ARG_ADDR(1)
```

Definition at line 58 of file handler_utils.h.

#define DECL_3_ARGS( )

Value:

```
DECL_2_ARGS();                                          \
    struct spe_reg128 *arg2 = LS_ARG_ADDR(2)
```

Definition at line 62 of file handler_utils.h.

#define DECL_4_ARGS( )

Value:

```
DECL_3_ARGS();                                          \
    struct spe_reg128 *arg3 = LS_ARG_ADDR(3)
```

Definition at line 66 of file handler_utils.h.

#define DECL_5_ARGS( )

Value:

```
DECL_4_ARGS();                                          \
    struct spe_reg128 *arg4 = LS_ARG_ADDR(4)
```

Definition at line 70 of file handler_utils.h.

#define DECL_6_ARGS( )

Value:

```
DECL_5_ARGS();                                          \
    struct spe_reg128 *arg5 = LS_ARG_ADDR(5)
```

Definition at line 74 of file handler_utils.h.

#define DECL_RET( ) struct spe_reg128 *ret = LS_ARG_ADDR(0)

Definition at line 42 of file handler_utils.h.

#define GET_LS_PTR(*_off*) (void *) ((char *) ls + ((_off) & LS_ADDR_MASK))

Definition at line 45 of file handler_utils.h.

#define GET_LS_PTR_NULL(*_off*) ((_off) ? GET_LS_PTR(_off) : NULL)

Definition at line 48 of file handler_utils.h.

#define LS_ADDR_MASK (LS_SIZE - 1)

Definition at line 29 of file handler_utils.h.

#define LS_ARG_ADDR(*_index*) (&((struct spe_reg128 *) ((char *) ls + ls_args))[_index])

Definition at line 39 of file handler_utils.h.

#define LS_SIZE 0x40000 /* 256K (in bytes) */

Definition at line 28 of file handler_utils.h.

#define PUT_LS_RC(*_a, _b, _c, _d*)

Value:

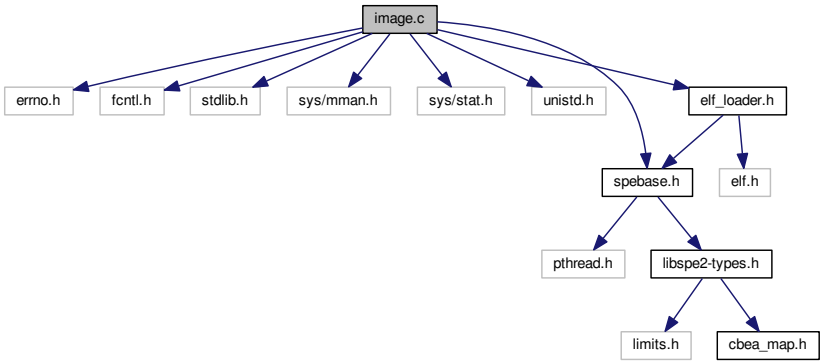
```
ret->slot[0] = (unsigned int) (_a);                 \
    ret->slot[1] = (unsigned int) (_b);                 \
    ret->slot[2] = (unsigned int) (_c);                 \
    ret->slot[3] = (unsigned int) (_d);                 \
    __asm__ __volatile__ ("sync" : : : "memory")
```

Definition at line 78 of file handler_utils.h.

3.11 image.c File Reference

```
#include <errno.h>
#include <fcntl.h>
#include <stdlib.h>
#include <sys/mman.h>
#include <sys/stat.h>
#include <unistd.h>
#include "elf_loader.h"
#include "spebase.h"
```

Include dependency graph for image.c:



Data Structures

- struct image_handle

Functions

- spe_program_handle_t * _base_spe_image_open (const char *filename)
- int _base_spe_image_close (spe_program_handle_t *handle)

3.11.1 Function Documentation

int _base_spe_image_close (spe_program_handle_t * *handle*)

_base_spe_image_close unmaps an SPE ELF object that was previously mapped using spe_open_image.
Parameters

handle	handle to open file

Return values

0	On success, spe_close_image returns 0.
-1	On failure, -1 is returned and errno is set appropriately. Possible values for errno: EINVAL From spe_close_image, this indicates that the file, specified by filename, was not previously mapped by a call to spe_open_image.

Definition at line 96 of file image.c.

References spe_program_handle::elf_image, image_handle::map_size, image_handle::speh, and spe_program_handle::toe_shadow.

```
97 {
98         int ret = 0;
99         struct image_handle *ih;
100
101         if (!handle) {
102                 errno = EINVAL;
103                 return -1;
104         }
105
106         ih = (struct image_handle *)handle;
107
```

```
108         if (!ih->speh.elf_image || !ih->map_size) {
109                 errno = EINVAL;
110                 return -1;
111         }
112
113         if (ih->speh.toe_shadow)
114                 free(ih->speh.toe_shadow);
115
116         ret = munmap(ih->speh.elf_image, ih->map_size );
117         free(handle);
118
119         return ret;
120 }
```

spe_program_handle_t* _base_spe_image_open (const char * *filename*)

_base_spe_image_open maps an SPE ELF executable indicated by filename into system memory and returns the mapped address appropriate for use by the spe_create_thread API. It is often more convenient/appropriate to use the loading methodologies where SPE ELF objects are converted to PPE static or shared libraries with symbols which point to the SPE ELF objects after these special libraries are loaded. These libraries are then linked with the associated PPE code to provide a direct symbol reference to the SPE ELF object. The symbols in this scheme are equivalent to the address returned from the spe_open_image function. SPE ELF objects loaded using this function are not shared with other processes, but SPE ELF objects loaded using the other scheme, mentioned above, can be shared if so desired.

Parameters

filename	Specifies the filename of an SPE ELF executable to be loaded and mapped into system memory.

Returns

On success, spe_open_image returns the address at which the specified SPE ELF object has been mapped. On failure, NULL is returned and errno is set appropriately.
Possible values for errno include:
EACCES The calling process does not have permission to access the specified file.
EFAULT The filename parameter points to an address that was not contained in the calling process's address space.

A number of other errno values could be returned by the open(2), fstat(2), mmap(2), munmap(2), or close(2) system calls which may be utilized by the spe_open_image or spe_close_image functions.

See Also

spe_create_thread

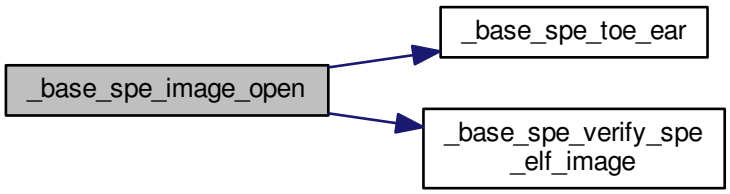
Definition at line 37 of file image.c.

References _base_spe_toe_ear(), _base_spe_verify_spe_elf_image(), spe_program_handle::elf_image, spe_program_handle::handle_size, image_handle::map_size, image_handle::speh, and spe_program_handle::toe_shadow.

```
38 {
39         /* allocate an extra integer in the spe handle to keep the mapped size information */
40         struct image_handle *ret;
41         int binfd = -1, f_stat;
42         struct stat statbuf;
43         size_t ps = getpagesize ();
44
45         ret = malloc(sizeof(struct image_handle));
46         if (!ret)
47                 return NULL;
48
49         ret->speh.handle_size = sizeof(spe_program_handle_t);
50         ret->speh.toe_shadow = NULL;
51
```

```
52          binfd = open(filename, O_RDONLY);
53          if (binfd < 0)
54                  goto ret_err;
55
56          f_stat = fstat(binfd, &statbuf);
57          if (f_stat < 0)
58                  goto ret_err;
59
60          /* Sanity: is it executable ?
61           */
62          if(!(statbuf.st_mode & (S_IXUSR | S_IXGRP | S_IXOTH))) {
63                  errno=EACCES;
64                  goto ret_err;
65          }
66
67          /* now store the size at the extra allocated space */
68          ret->map_size = (statbuf.st_size + ps - 1) & ~(ps - 1);
69
70          ret->speh.elf_image = mmap(NULL, ret->map_size,
71                                                          PROT_WRITE | PROT_READ,
72                                                          MAP_PRIVATE, binfd, 0);
73          if (ret->speh.elf_image == MAP_FAILED)
74                  goto ret_err;
75
76          /*Verify that this is a valid SPE ELF object*/
77          if((_base_spe_verify_spe_elf_image((
    spe_program_handle_t *)ret)))
78                  goto ret_err;
79
80          if (_base_spe_toe_ear(&ret->speh))
81                  goto ret_err;
82
83          /* ok */
84          close(binfd);
85          return (spe_program_handle_t *)ret;
86
87          /* err & cleanup */
88  ret_err:
89          if (binfd >= 0)
90                  close(binfd);
91
92          free(ret);
93          return NULL;
94  }
```

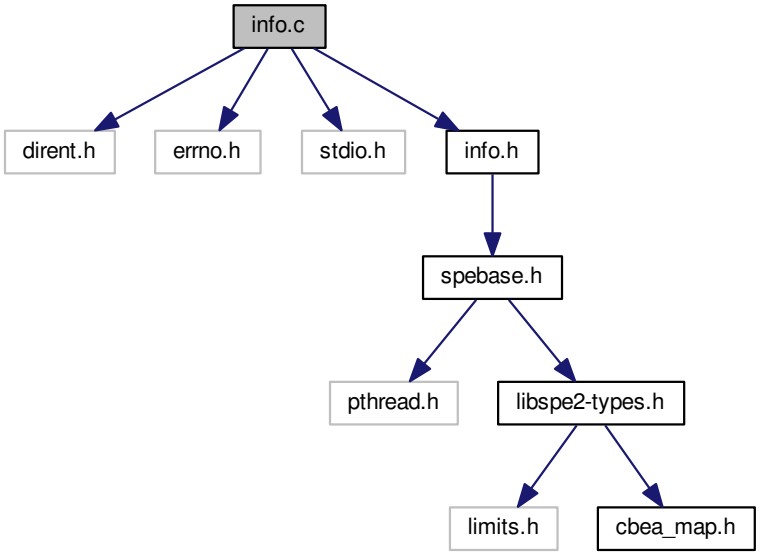
Here is the call graph for this function:



3.12 info.c File Reference

```
#include <dirent.h>
#include <errno.h>
#include <stdio.h>
#include "info.h"
```

Include dependency graph for info.c:



Functions

- int _base_spe_count_physical_cpus (int cpu_node)
- int _base_spe_count_usable_spes (int cpu_node)
- int _base_spe_count_physical_spes (int cpu_node)
- int _base_spe_cpu_info_get (int info_requested, int cpu_node)

3.12.1 Function Documentation

int _base_spe_count_physical_cpus (int *cpu_node*)

Definition at line 30 of file info.c.
References DEBUG_PRINTF, and THREADS_PER_BE.
Referenced by _base_spe_count_physical_spes(), and _base_spe_cpu_info_get().

```
31 {
32         const char    *buff = "/sys/devices/system/cpu";
33         DIR     *dirp;
34         int ret = -2;
35         struct  dirent  *dptr;
36 
37         DEBUG_PRINTF ("spe_count_physical_cpus()\n");
38 
39         // make sure, cpu_node is in the correct range
40         if (cpu_node != -1) {
41                 errno = EINVAL;
42                 return -1;
43         }
44 
45         // Count number of CPUs in /sys/devices/system/cpu
46         if((dirp=opendir(buff))==NULL) {
47                 fprintf(stderr,"Error opening %s ",buff);
48                 perror("dirlist");
49                 errno = EINVAL;
```

```
50                 return -1;
51         }
52     while((dptr=readdir(dirp))) {
53                 ret++;
54         }
55         closedir(dirp);
56         return ret/THREADS_PER_BE;
57 }
```

int _base_spe_count_physical_spes (int *cpu_node*)

Definition at line 71 of file info.c.

References _base_spe_count_physical_cpus(), and DEBUG_PRINTF.

Referenced by _base_spe_count_usable_spes(), and _base_spe_cpu_info_get().

```
72 {
73         const char      *buff = "/sys/devices/system/spu";
74         DIR     *dirp;
75         int ret = -2;
76         struct  dirent  *dptr;
77         int no_of_bes;
78 
79         DEBUG_PRINTF ("spe_count_physical_spes()\n");
80 
81         // make sure, cpu_node is in the correct range
82         no_of_bes = _base_spe_count_physical_cpus(-1);
83         if (cpu_node < -1 || cpu_node >= no_of_bes ) {
84                 errno = EINVAL;
85                 return -1;
86         }
87 
88         // Count number of SPUs in /sys/devices/system/spu
89         if((dirp=opendir(buff))==NULL) {
90                 fprintf(stderr,"Error opening %s ",buff);
91                 perror("dirlist");
92                 errno = EINVAL;
93                 return -1;
94         }
95     while((dptr=readdir(dirp))) {
96                 ret++;
97         }
98         closedir(dirp);
99 
100         if(cpu_node != -1) ret /= no_of_bes; // FIXME
101         return ret;
102 }
```

Here is the call graph for this function:

int _base_spe_count_usable_spes (int *cpu_node*)

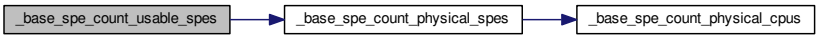
Definition at line 62 of file info.c.

References _base_spe_count_physical_spes().

Referenced by _base_spe_cpu_info_get().

```
63 {
64         return _base_spe_count_physical_spes(cpu_node); // FIXME
65 }
```

Here is the call graph for this function:



int _base_spe_cpu_info_get (int *info_requested*, int *cpu_node*)

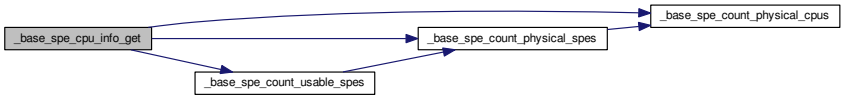
_base_spe_info_get

Definition at line 105 of file info.c.

References _base_spe_count_physical_cpus(), _base_spe_count_physical_spes(), _base_spe_count_usable_spes(), SPE_COUNT_PHYSICAL_CPU_NODES, SPE_COUNT_PHYSICAL_SPES, and SPE_COUNT_USABLE_SPES.

```
105                                                             {
106         int ret = 0;
107         errno = 0;
108
109         switch (info_requested) {
110         case  SPE_COUNT_PHYSICAL_CPU_NODES:
111                 ret = _base_spe_count_physical_cpus(cpu_node);
112                 break;
113         case SPE_COUNT_PHYSICAL_SPES:
114                 ret = _base_spe_count_physical_spes(cpu_node);
115                 break;
116         case SPE_COUNT_USABLE_SPES:
117                 ret = _base_spe_count_usable_spes(cpu_node);
118                 break;
119         default:
120                 errno = EINVAL;
121                 ret = -1;
122         }
123         return ret;
124 }
```

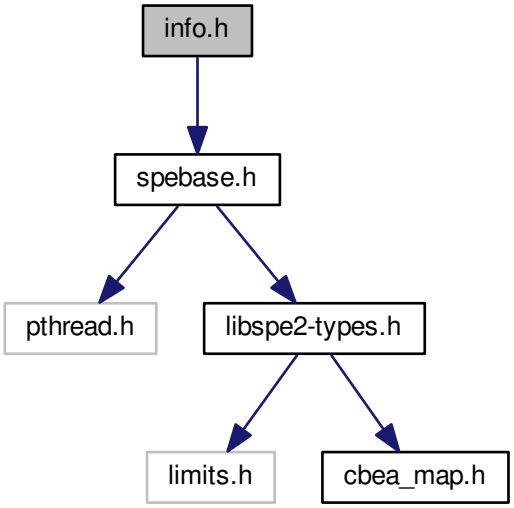
Here is the call graph for this function:



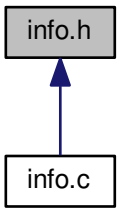
3.13 info.h File Reference

```
#include "spebase.h"
```

Include dependency graph for info.h:



This graph shows which files directly or indirectly include this file:



Macros

- #define THREADS_PER_BE 2

Functions

- int _base_spe_count_physical_cpus (int cpu_node)
- int _base_spe_count_physical_spes (int cpu_node)
- int _base_spe_count_usable_spes (int cpu_node)

3.13.1 Macro Definition Documentation

#define THREADS_PER_BE 2

Definition at line 25 of file info.h.
Referenced by _base_spe_count_physical_cpus().

3.13.2 Function Documentation

int _base_spe_count_physical_cpus (int *cpu_node*)

Definition at line 30 of file info.c.
References DEBUG_PRINTF, and THREADS_PER_BE.
Referenced by _base_spe_count_physical_spes(), and _base_spe_cpu_info_get().

```
31 {
32         const char    *buff = "/sys/devices/system/cpu";
33         DIR     *dirp;
34         int ret = -2;
35         struct  dirent  *dptr;
36
37         DEBUG_PRINTF ("spe_count_physical_cpus()\n");
38
39         // make sure, cpu_node is in the correct range
40         if (cpu_node != -1) {
41                 errno = EINVAL;
42                 return -1;
43         }
44
45         // Count number of CPUs in /sys/devices/system/cpu
46         if((dirp=opendir(buff))==NULL) {
47                 fprintf(stderr,"Error opening %s ",buff);
48                 perror("dirlist");
49                 errno = EINVAL;
50                 return -1;
51         }
52     while((dptr=readdir(dirp))) {
53                 ret++;
54         }
55         closedir(dirp);
56         return ret/THREADS_PER_BE;
57 }
```

int _base_spe_count_physical_spes (int *cpu_node*)

Definition at line 71 of file info.c.
References _base_spe_count_physical_cpus(), and DEBUG_PRINTF.
Referenced by _base_spe_count_usable_spes(), and _base_spe_cpu_info_get().

```
72 {
73         const char      *buff = "/sys/devices/system/spu";
74         DIR     *dirp;
75         int ret = -2;
76         struct  dirent  *dptr;
77         int no_of_bes;
78
79         DEBUG_PRINTF ("spe_count_physical_spes()\n");
80
81         // make sure, cpu_node is in the correct range
82         no_of_bes = _base_spe_count_physical_cpus(-1);
83         if (cpu_node < -1 || cpu_node >= no_of_bes ) {
84                 errno = EINVAL;
85                 return -1;
86         }
87
88         // Count number of SPUs in /sys/devices/system/spu
89         if((dirp=opendir(buff))==NULL) {
90                 fprintf(stderr,"Error opening %s ",buff);
91                 perror("dirlist");
92                 errno = EINVAL;
93                 return -1;
```

```
94          }
95      while((dptr=readdir(dirp))) {
96                  ret++;
97          }
98          closedir(dirp);
99
100          if(cpu_node != -1) ret /= no_of_bes; // FIXME
101          return ret;
102 }
```

Here is the call graph for this function:

int _base_spe_count_usable_spes (int *cpu_node*)

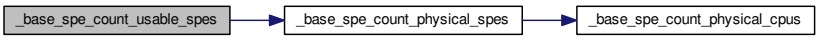
Definition at line 62 of file info.c.

References _base_spe_count_physical_spes().

Referenced by _base_spe_cpu_info_get().

```
63 {
64          return _base_spe_count_physical_spes(cpu_node); // FIXME
65 }
```

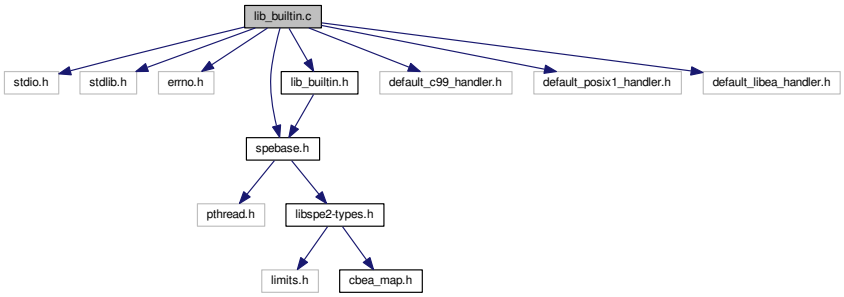
Here is the call graph for this function:



3.14 lib_builtin.c File Reference

```
#include <stdio.h>
#include <stdlib.h>
#include <errno.h>
#include "spebase.h"
#include "lib_builtin.h"
#include "default_c99_handler.h"
#include "default_posix1_handler.h"
#include "default_libea_handler.h"
```

Include dependency graph for lib_builtin.c:



Macros

- #define HANDLER_IDX(x) (x & 0xff)

Functions

- int _base_spe_callback_handler_register (void *handler, unsigned int callnum, unsigned int mode)
- int _base_spe_callback_handler_deregister (unsigned int callnum)
- void * _base_spe_callback_handler_query (unsigned int callnum)
- int _base_spe_handle_library_callback (struct spe_context *spe, int callnum, unsigned int npc)

3.14.1 Macro Definition Documentation

#define HANDLER_IDX(*x*) (x & 0xff)

Definition at line 29 of file lib_builtin.c.

3.14.2 Function Documentation

int _base_spe_callback_handler_deregister (unsigned int *callnum*)

unregister a handler function for the specified number NOTE: unregistering a handler from call zero and one is ignored.

Definition at line 78 of file lib_builtin.c.

References MAX_CALLNUM, and RESERVED.

```
79 {
80         errno = 0;
81         if (callnum > MAX_CALLNUM) {
82                 errno = EINVAL;
83                 return -1;
84         }
85         if (callnum < RESERVED) {
86                 errno = EACCES;
87                 return -1;
88         }
89         if (handlers[callnum] == NULL) {
90                 errno = ESRCH;
91                 return -1;
92         }
93
94         handlers[callnum] = NULL;
95         return 0;
96 }
```

void* _base_spe_callback_handler_query (unsigned int *callnum*)

query a handler function for the specified number

Definition at line 98 of file lib_builtin.c.

References MAX_CALLNUM.

```
99 {
100         errno = 0;
101
102         if (callnum > MAX_CALLNUM) {
103                 errno = EINVAL;
104                 return NULL;
105         }
106         if (handlers[callnum] == NULL) {
107                 errno = ESRCH;
108                 return NULL;
109         }
110         return handlers[callnum];
111 }
```

int _base_spe_callback_handler_register (void * *handler*, unsigned int *callnum*, unsigned int *mode*)

register a handler function for the specified number NOTE: registering a handler to call zero and one is ignored.

Definition at line 40 of file lib_builtin.c.

References MAX_CALLNUM, RESERVED, SPE_CALLBACK_NEW, and SPE_CALLBACK_UPDATE.

```
41 {
42         errno = 0;
43
44         if (callnum > MAX_CALLNUM) {
45                 errno = EINVAL;
46                 return -1;
47         }
48
49         switch(mode){
50         case SPE_CALLBACK_NEW:
51                 if (callnum < RESERVED) {
52                         errno = EACCES;
53                         return -1;
54                 }
55                 if (handlers[callnum] != NULL) {
56                         errno = EACCES;
57                         return -1;
58                 }
59                 handlers[callnum] = handler;
60                 break;
61
62         case SPE_CALLBACK_UPDATE:
63                 if (handlers[callnum] == NULL) {
64                         errno = ESRCH;
65                         return -1;
66                 }
67                 handlers[callnum] = handler;
68                 break;
69         default:
70                 errno = EINVAL;
71                 return -1;
72                 break;
73         }
74         return 0;
75
76 }
```

int _base_spe_handle_library_callback (struct spe_context * *spe*, int *callnum*, unsigned int *npc*)

Definition at line 113 of file lib_builtin.c.

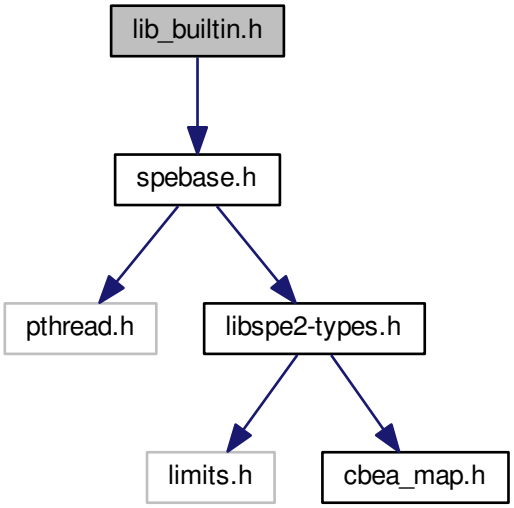
References spe_context::base_private, DEBUG_PRINTF, spe_context_base_priv::flags, spe_context_base_priv::mem_mmap_base, SPE_EMULATE_PARAM_BUFFER, and SPE_ISOLATE_EMULATE.

Referenced by _base_spe_context_run().

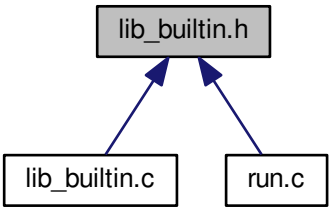
```
115 {
116         int (*handler)(void *, unsigned int);
117         int rc;
118 
119         errno = 0;
120         if (!handlers[callnum]) {
121                 DEBUG_PRINTF ("No SPE library handler registered for this call.\n");
122                 errno=ENOSYS;
123                 return -1;
124         }
125 
126         handler=handlers[callnum];
127 
128         /* For emulated isolation mode, position the
129          * npc so that the buffer for the PPE-assisted
130          * library calls can be accessed. */
131         if (spe->base_private->flags & SPE_ISOLATE_EMULATE)
132                 npc = SPE_EMULATE_PARAM_BUFFER;
133 
134         rc = handler(spe->base_private->mem_mmap_base, npc);
135         if (rc) {
136                 DEBUG_PRINTF ("SPE library call unsupported.\n");
137                 errno=ENOSYS;
138                 return rc;
139         }
140         return 0;
141 }
```

3.15 lib_builtin.h File Reference

`#include "spebase.h"`
Include dependency graph for lib_builtin.h:



This graph shows which files directly or indirectly include this file:



Macros

- #define MAX_CALLNUM 255
- #define RESERVED 4

Functions

- int _base_spe_handle_library_callback (struct spe_context *spe, int callnum, unsigned int npc)

3.15.1 Macro Definition Documentation

#define MAX_CALLNUM 255

Definition at line 25 of file lib_builtin.h.

Referenced by _base_spe_callback_handler_deregister(), _base_spe_callback_handler_query(), and _base_spe_callback_handler_register().

#define RESERVED 4

Definition at line 26 of file lib_builtin.h.

Referenced by _base_spe_callback_handler_deregister(), and _base_spe_callback_handler_register().

3.15.2 Function Documentation

int _base_spe_handle_library_callback (struct spe_context * *spe*, int *callnum*, unsigned int *npc*)

Definition at line 113 of file lib_builtin.c.

References spe_context::base_private, DEBUG_PRINTF, spe_context_base_priv::flags, spe_context_base_priv::mem_mmap_base, SPE_EMULATE_PARAM_BUFFER, and SPE_ISOLATE_EMULATE.

Referenced by _base_spe_context_run().

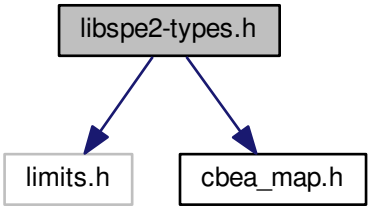
```
115 {
116         int (*handler)(void *, unsigned int);
117         int rc;
118
119         errno = 0;
120         if (!handlers[callnum]) {
121                 DEBUG_PRINTF ("No SPE library handler registered for this call.\n");
122                 errno=ENOSYS;
123                 return -1;
124         }
125
```

```
126         handler=handlers[callnum];
127
128         /* For emulated isolation mode, position the
129          * npc so that the buffer for the PPE-assisted
130          * library calls can be accessed. */
131         if (spe->base_private->flags & SPE_ISOLATE_EMULATE)
132                 npc = SPE_EMULATE_PARAM_BUFFER;
133
134         rc = handler(spe->base_private->mem_mmap_base, npc);
135         if (rc) {
136                 DEBUG_PRINTF ("SPE library call unsupported.\n");
137                 errno=ENOSYS;
138                 return rc;
139         }
140         return 0;
141 }
```

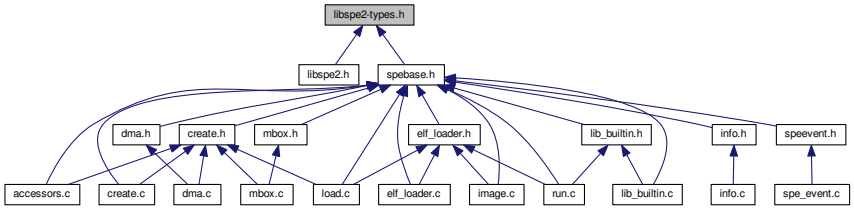
3.16 libspe2-types.h File Reference

```
#include <limits.h>
#include "cbea_map.h"
```

Include dependency graph for libspe2-types.h:



This graph shows which files directly or indirectly include this file:



Data Structures

- struct spe_program_handle
- struct spe_context
- struct spe_gang_context
- struct spe_stop_info
- union spe_event_data

- struct spe_event_unit

Macros

- #define SPE_CFG_SIGNOTIFY1_OR 0x00000010
- #define SPE_CFG_SIGNOTIFY2_OR 0x00000020
- #define SPE_MAP_PS 0x00000040
- #define SPE_ISOLATE 0x00000080
- #define SPE_ISOLATE_EMULATE 0x00000100
- #define SPE_EVENTS_ENABLE 0x00001000
- #define SPE_AFFINITY_MEMORY 0x00002000
- #define SPE_EXIT 1
- #define SPE_STOP_AND_SIGNAL 2
- #define SPE_RUNTIME_ERROR 3
- #define SPE_RUNTIME_EXCEPTION 4
- #define SPE_RUNTIME_FATAL 5
- #define SPE_CALLBACK_ERROR 6
- #define SPE_ISOLATION_ERROR 7
- #define SPE_SPU_STOPPED_BY_STOP 0x02 /* INTERNAL USE ONLY */
- #define SPE_SPU_HALT 0x04
- #define SPE_SPU_WAITING_ON_CHANNEL 0x08 /* INTERNAL USE ONLY */
- #define SPE_SPU_SINGLE_STEP 0x10
- #define SPE_SPU_INVALID_INSTR 0x20
- #define SPE_SPU_INVALID_CHANNEL 0x40
- #define SPE_DMA_ALIGNMENT 0x0008
- #define SPE_DMA_SEGMENTATION 0x0020
- #define SPE_DMA_STORAGE 0x0040
- #define SPE_INVALID_DMA 0x0800
- #define SIGSPE SIGURG
- #define SPE_EVENT_OUT_INTR_MBOX 0x00000001
- #define SPE_EVENT_IN_MBOX 0x00000002
- #define SPE_EVENT_TAG_GROUP 0x00000004
- #define SPE_EVENT_SPE_STOPPED 0x00000008
- #define SPE_EVENT_ALL_EVENTS
- #define SPE_MBOX_ALL_BLOCKING 1
- #define SPE_MBOX_ANY_BLOCKING 2
- #define SPE_MBOX_ANY_NONBLOCKING 3
- #define SPE_TAG_ALL 1
- #define SPE_TAG_ANY 2
- #define SPE_TAG_IMMEDIATE 3
- #define SPE_DEFAULT_ENTRY UINT_MAX
- #define SPE_RUN_USER_REGS 0x00000001 /* 128b user data for r3-5. */
- #define SPE_NO_CALLBACKS 0x00000002
- #define SPE_CALLBACK_NEW 1
- #define SPE_CALLBACK_UPDATE 2
- #define SPE_COUNT_PHYSICAL_CPU_NODES 1
- #define SPE_COUNT_PHYSICAL_SPES 2
- #define SPE_COUNT_USABLE_SPES 3
- #define SPE_SIG_NOTIFY_REG_1 0x0001
- #define SPE_SIG_NOTIFY_REG_2 0x0002

Typedefs

- typedef struct spe_program_handle spe_program_handle_t
- typedef struct spe_context * spe_context_ptr_t
- typedef struct spe_gang_context * spe_gang_context_ptr_t
- typedef struct spe_stop_info spe_stop_info_t
- typedef union spe_event_data spe_event_data_t
- typedef struct spe_event_unit spe_event_unit_t
- typedef void * spe_event_handler_ptr_t
- typedef int spe_event_handler_t

Enumerations

- enum ps_area {
  SPE_MSSYNC_AREA, SPE_MFC_COMMAND_AREA, SPE_CONTROL_AREA, SPE_SIG_NOTIFY_1_AREA,
  SPE_SIG_NOTIFY_2_AREA }

3.16.1 Macro Definition Documentation

#define SIGSPE SIGURG

SIGSPE maps to SIGURG
Definition at line 219 of file libspe2-types.h.

#define SPE_AFFINITY_MEMORY 0x00002000

Definition at line 182 of file libspe2-types.h.
Referenced by _base_spe_context_create().

#define SPE_CALLBACK_ERROR 6

Definition at line 194 of file libspe2-types.h.
Referenced by _base_spe_context_run().

#define SPE_CALLBACK_NEW 1

Definition at line 260 of file libspe2-types.h.
Referenced by _base_spe_callback_handler_register().

#define SPE_CALLBACK_UPDATE 2

Definition at line 261 of file libspe2-types.h.
Referenced by _base_spe_callback_handler_register().

#define SPE_CFG_SIGNOTIFY1_OR 0x00000010

Flags for spe_context_create
Definition at line 176 of file libspe2-types.h.
Referenced by _base_spe_context_create().

#define SPE_CFG_SIGNOTIFY2_OR 0x00000020

Definition at line 177 of file libspe2-types.h.
Referenced by _base_spe_context_create().

#define SPE_COUNT_PHYSICAL_CPU_NODES 1

Definition at line 265 of file libspe2-types.h.
Referenced by _base_spe_cpu_info_get().

#define SPE_COUNT_PHYSICAL_SPES 2

Definition at line 266 of file libspe2-types.h.
Referenced by _base_spe_cpu_info_get().

#define SPE_COUNT_USABLE_SPES 3

Definition at line 267 of file libspe2-types.h.
Referenced by _base_spe_cpu_info_get().

#define SPE_DEFAULT_ENTRY UINT_MAX

Flags for _base_spe_context_run
Definition at line 253 of file libspe2-types.h.
Referenced by _base_spe_context_run().

#define SPE_DMA_ALIGNMENT 0x0008

Runtime exceptions
Definition at line 210 of file libspe2-types.h.

#define SPE_DMA_SEGMENTATION 0x0020

Definition at line 212 of file libspe2-types.h.

#define SPE_DMA_STORAGE 0x0040

Definition at line 213 of file libspe2-types.h.

#define SPE_EVENT_ALL_EVENTS

Value:

```
SPE_EVENT_OUT_INTR_MBOX | \
                                        SPE_EVENT_IN_MBOX |
      \
                                        SPE_EVENT_TAG_GROUP |
      \
                                        SPE_EVENT_SPE_STOPPED
```

Definition at line 229 of file libspe2-types.h.

#define SPE_EVENT_IN_MBOX 0x00000002

Definition at line 225 of file libspe2-types.h.
Referenced by _event_spe_event_handler_deregister(), and _event_spe_event_handler_register().

#define SPE_EVENT_OUT_INTR_MBOX 0x00000001

Supported SPE events
Definition at line 224 of file libspe2-types.h.
Referenced by _event_spe_event_handler_deregister(), and _event_spe_event_handler_register().

#define SPE_EVENT_SPE_STOPPED 0x00000008

Definition at line 227 of file libspe2-types.h.
Referenced by _event_spe_event_handler_deregister(), and _event_spe_event_handler_register().

#define SPE_EVENT_TAG_GROUP 0x00000004

Definition at line 226 of file libspe2-types.h.
Referenced by _event_spe_event_handler_deregister(), and _event_spe_event_handler_register().

#define SPE_EVENTS_ENABLE 0x00001000

Definition at line 181 of file libspe2-types.h.
Referenced by _base_spe_context_create(), and _base_spe_context_run().

#define SPE_EXIT 1

Symbolic constants for stop reasons as returned in spe_stop_info_t
Definition at line 189 of file libspe2-types.h.
Referenced by _base_spe_context_run().

#define SPE_INVALID_DMA 0x0800

Definition at line 214 of file libspe2-types.h.

#define SPE_ISOLATE 0x00000080

Definition at line 179 of file libspe2-types.h.
Referenced by _base_spe_context_create(), _base_spe_context_run(), and _base_spe_program_load().

#define SPE_ISOLATE_EMULATE 0x00000100

Definition at line 180 of file libspe2-types.h.
Referenced by _base_spe_context_create(), _base_spe_context_run(), _base_spe_handle_library_callback(), and _base_spe_program_load().

#define SPE_ISOLATION_ERROR 7

Definition at line 195 of file libspe2-types.h.
Referenced by _base_spe_context_run().

#define SPE_MAP_PS 0x00000040

Definition at line 178 of file libspe2-types.h.
Referenced by _base_spe_context_create(), _base_spe_in_mbox_status(), _base_spe_in_mbox_write(), _base_spe_mfcio_tag_status_read(), _base_spe_mssync_start(), _base_spe_mssync_status(), _base_spe_out_intr_mbox_status(), _base_spe_out_mbox_read(), _base_spe_out_mbox_status(), _base_spe_signal_write(), and _event_spe_event_handler_register().

#define SPE_MBOX_ALL_BLOCKING 1

Behavior flags for mailbox read/write functions
Definition at line 237 of file libspe2-types.h.
Referenced by _base_spe_in_mbox_write(), and _base_spe_out_intr_mbox_read().

#define SPE_MBOX_ANY_BLOCKING 2

Definition at line 238 of file libspe2-types.h.
Referenced by _base_spe_in_mbox_write(), and _base_spe_out_intr_mbox_read().

#define SPE_MBOX_ANY_NONBLOCKING 3

Definition at line 239 of file libspe2-types.h.
Referenced by _base_spe_in_mbox_write(), and _base_spe_out_intr_mbox_read().

#define SPE_NO_CALLBACKS 0x00000002

Definition at line 255 of file libspe2-types.h.
Referenced by _base_spe_context_run().

#define SPE_RUN_USER_REGS 0x00000001 /∗ 128b user data for r3-5. ∗/

Definition at line 254 of file libspe2-types.h.
Referenced by _base_spe_context_run().

#define SPE_RUNTIME_ERROR 3

Definition at line 191 of file libspe2-types.h.
Referenced by _base_spe_context_run().

#define SPE_RUNTIME_EXCEPTION 4

Definition at line 192 of file libspe2-types.h.
Referenced by _base_spe_context_run().

#define SPE_RUNTIME_FATAL 5

Definition at line 193 of file libspe2-types.h.
Referenced by _base_spe_context_run().

#define SPE_SIG_NOTIFY_REG_1 0x0001

Signal Targets
Definition at line 272 of file libspe2-types.h.
Referenced by _base_spe_signal_write().

#define SPE_SIG_NOTIFY_REG_2 0x0002

Definition at line 273 of file libspe2-types.h.
Referenced by _base_spe_signal_write().

#define SPE_SPU_HALT 0x04

Definition at line 201 of file libspe2-types.h.
Referenced by _base_spe_context_run().

#define SPE_SPU_INVALID_CHANNEL 0x40

Definition at line 205 of file libspe2-types.h.
Referenced by _base_spe_context_run().

#define SPE_SPU_INVALID_INSTR 0x20

Definition at line 204 of file libspe2-types.h.
Referenced by _base_spe_context_run().

#define SPE_SPU_SINGLE_STEP 0x10

Definition at line 203 of file libspe2-types.h.

#define SPE_SPU_STOPPED_BY_STOP 0x02 /* INTERNAL USE ONLY */

Runtime errors
Definition at line 200 of file libspe2-types.h.
Referenced by _base_spe_context_run().

#define SPE_SPU_WAITING_ON_CHANNEL 0x08 /* INTERNAL USE ONLY */

Definition at line 202 of file libspe2-types.h.
Referenced by _base_spe_context_run().

#define SPE_STOP_AND_SIGNAL 2

Definition at line 190 of file libspe2-types.h.
Referenced by _base_spe_context_run().

#define SPE_TAG_ALL 1

Behavior flags tag status functions
Definition at line 245 of file libspe2-types.h.
Referenced by _base_spe_mfcio_tag_status_read().

#define SPE_TAG_ANY 2

Definition at line 246 of file libspe2-types.h.
Referenced by _base_spe_mfcio_tag_status_read().

#define SPE_TAG_IMMEDIATE 3

Definition at line 247 of file libspe2-types.h.
Referenced by _base_spe_mfcio_tag_status_read().

3.16.2 Typedef Documentation

typedef struct spe_context* spe_context_ptr_t

spe_context_ptr_t This pointer serves as the identifier for a specific SPE context throughout the API (where needed)
Definition at line 83 of file libspe2-types.h.

typedef union spe_event_data spe_event_data_t

spe_event_data_t User data to be associated with an event

typedef void* spe_event_handler_ptr_t

Definition at line 159 of file libspe2-types.h.

typedef int spe_event_handler_t

Definition at line 160 of file libspe2-types.h.

typedef struct spe_event_unit spe_event_unit_t

spe_event_t

typedef struct spe_gang_context* spe_gang_context_ptr_t

spe_gang_context_ptr_t This pointer serves as the identifier for a specific SPE gang context throughout the API (where needed)

Definition at line 106 of file libspe2-types.h.

typedef struct spe_program_handle spe_program_handle_t

SPE program handle Structure spe_program_handle per CESOF specification libspe2 applications usually only keep a pointer to the program handle and do not use the structure directly.

typedef struct spe_stop_info spe_stop_info_t

spe_stop_info_t

3.16.3 Enumeration Type Documentation

enum ps_area

Enumerator

SPE_MSSYNC_AREA

SPE_MFC_COMMAND_AREA

SPE_CONTROL_AREA

SPE_SIG_NOTIFY_1_AREA

SPE_SIG_NOTIFY_2_AREA

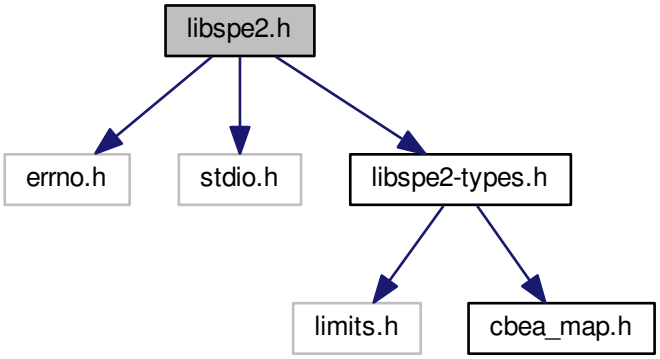
Definition at line 171 of file libspe2-types.h.

```
171 { SPE_MSSYNC_AREA, SPE_MFC_COMMAND_AREA,
      SPE_CONTROL_AREA, SPE_SIG_NOTIFY_1_AREA,
      SPE_SIG_NOTIFY_2_AREA };
```

3.17 libspe2.h File Reference

```
#include <errno.h>
#include <stdio.h>
#include "libspe2-types.h"
```

Include dependency graph for libspe2.h:



Functions

- spe_context_ptr_t spe_context_create (unsigned int flags, spe_gang_context_ptr_t gang)
- spe_context_ptr_t spe_context_create_affinity (unsigned int flags, spe_context_ptr_t affinity_neighbor, spe_gang_context_ptr_t gang)
- int spe_context_destroy (spe_context_ptr_t spe)
- spe_gang_context_ptr_t spe_gang_context_create (unsigned int flags)
- int spe_gang_context_destroy (spe_gang_context_ptr_t gang)
- spe_program_handle_t * spe_image_open (const char *filename)
- int spe_image_close (spe_program_handle_t *program)
- int spe_program_load (spe_context_ptr_t spe, spe_program_handle_t *program)
- int spe_context_run (spe_context_ptr_t spe, unsigned int *entry, unsigned int runflags, void *argp, void *envp, spe_stop_info_t *stopinfo)
- int spe_stop_info_read (spe_context_ptr_t spe, spe_stop_info_t *stopinfo)
- spe_event_handler_ptr_t spe_event_handler_create (void)
- int spe_event_handler_destroy (spe_event_handler_ptr_t evhandler)
- int spe_event_handler_register (spe_event_handler_ptr_t evhandler, spe_event_unit_t *event)
- int spe_event_handler_deregister (spe_event_handler_ptr_t evhandler, spe_event_unit_t *event)
- int spe_event_wait (spe_event_handler_ptr_t evhandler, spe_event_unit_t *events, int max_events, int timeout)
- int spe_mfcio_put (spe_context_ptr_t spe, unsigned int ls, void *ea, unsigned int size, unsigned int tag, unsigned int tid, unsigned int rid)
- int spe_mfcio_putb (spe_context_ptr_t spe, unsigned int ls, void *ea, unsigned int size, unsigned int tag, unsigned int tid, unsigned int rid)
- int spe_mfcio_putf (spe_context_ptr_t spe, unsigned int ls, void *ea, unsigned int size, unsigned int tag, unsigned int tid, unsigned int rid)
- int spe_mfcio_get (spe_context_ptr_t spe, unsigned int ls, void *ea, unsigned int size, unsigned int tag, unsigned int tid, unsigned int rid)
- int spe_mfcio_getb (spe_context_ptr_t spe, unsigned int ls, void *ea, unsigned int size, unsigned int tag, unsigned int tid, unsigned int rid)

- int spe_mfcio_getf (spe_context_ptr_t spe, unsigned int ls, void *ea, unsigned int size, unsigned int tag, unsigned int tid, unsigned int rid)
- int spe_mfcio_tag_status_read (spe_context_ptr_t spe, unsigned int mask, unsigned int behavior, unsigned int *tag_status)
- int spe_out_mbox_read (spe_context_ptr_t spe, unsigned int *mbox_data, int count)
- int spe_out_mbox_status (spe_context_ptr_t spe)
- int spe_in_mbox_write (spe_context_ptr_t spe, unsigned int *mbox_data, int count, unsigned int behavior)
- int spe_in_mbox_status (spe_context_ptr_t spe)
- int spe_out_intr_mbox_read (spe_context_ptr_t spe, unsigned int *mbox_data, int count, unsigned int behavior)
- int spe_out_intr_mbox_status (spe_context_ptr_t spe)
- int spe_mssync_start (spe_context_ptr_t spe)
- int spe_mssync_status (spe_context_ptr_t spe)
- int spe_signal_write (spe_context_ptr_t spe, unsigned int signal_reg, unsigned int data)
- void * spe_ls_area_get (spe_context_ptr_t spe)
- int spe_ls_size_get (spe_context_ptr_t spe)
- void * spe_ps_area_get (spe_context_ptr_t spe, enum ps_area area)
- int spe_callback_handler_register (void *handler, unsigned int callnum, unsigned int mode)
- int spe_callback_handler_deregister (unsigned int callnum)
- void * spe_callback_handler_query (unsigned int callnum)
- int spe_cpu_info_get (int info_requested, int cpu_node)

3.17.1 Function Documentation

int spe_callback_handler_deregister (unsigned int *callnum*)

void* spe_callback_handler_query (unsigned int *callnum*)

int spe_callback_handler_register (void * *handler*, unsigned int *callnum*, unsigned int *mode*)

spe_context_ptr_t spe_context_create (unsigned int *flags*, spe_gang_context_ptr_t *gang*)

spe_context_ptr_t spe_context_create_affinity (unsigned int *flags*, spe_context_ptr_t *affinity_neighbor*, spe_gang_context_ptr_t *gang*)

int spe_context_destroy (spe_context_ptr_t *spe*)

int spe_context_run (spe_context_ptr_t *spe*, unsigned int * *entry*, unsigned int *runflags*, void * *argp*, void * *envp*, spe_stop_info_t * *stopinfo*)

int spe_cpu_info_get (int *info_requested*, int *cpu_node*)

spe_event_handler_ptr_t spe_event_handler_create (void)

int spe_event_handler_deregister (spe_event_handler_ptr_t *evhandler*, spe_event_unit_t * *event*)

int spe_event_handler_destroy (spe_event_handler_ptr_t *evhandler*)

int spe_event_handler_register (spe_event_handler_ptr_t *evhandler*, spe_event_unit_t * *event*)

int spe_event_wait (spe_event_handler_ptr_t *evhandler*, spe_event_unit_t * *events*, int *max_events*, int *timeout*)

spe_gang_context_ptr_t spe_gang_context_create (unsigned int *flags*)

int spe_gang_context_destroy (spe_gang_context_ptr_t *gang*)

int spe_image_close (spe_program_handle_t * *program*)

spe_program_handle_t* spe_image_open (const char * *filename*)

int spe_in_mbox_status (spe_context_ptr_t *spe*)

int spe_in_mbox_write (spe_context_ptr_t *spe*, unsigned int * *mbox_data*, int *count*, unsigned int *behavior*)

void* spe_ls_area_get (spe_context_ptr_t *spe*)

int spe_ls_size_get (spe_context_ptr_t *spe*)

int spe_mfcio_get (spe_context_ptr_t *spe*, unsigned int *ls*, void * *ea*, unsigned int *size*, unsigned int *tag*, unsigned int *tid*, unsigned int *rid*)

int spe_mfcio_getb (spe_context_ptr_t *spe*, unsigned int *ls*, void * *ea*, unsigned int *size*, unsigned int *tag*, unsigned int *tid*, unsigned int *rid*)

int spe_mfcio_getf (spe_context_ptr_t *spe*, unsigned int *ls*, void * *ea*, unsigned int *size*, unsigned int *tag*, unsigned int *tid*, unsigned int *rid*)

int spe_mfcio_put (spe_context_ptr_t *spe*, unsigned int *ls*, void * *ea*, unsigned int *size*, unsigned int *tag*, unsigned int *tid*, unsigned int *rid*)

int spe_mfcio_putb (spe_context_ptr_t *spe*, unsigned int *ls*, void * *ea*, unsigned int *size*, unsigned int *tag*, unsigned int *tid*, unsigned int *rid*)

int spe_mfcio_putf (spe_context_ptr_t *spe*, unsigned int *ls*, void * *ea*, unsigned int *size*, unsigned int *tag*, unsigned int *tid*, unsigned int *rid*)

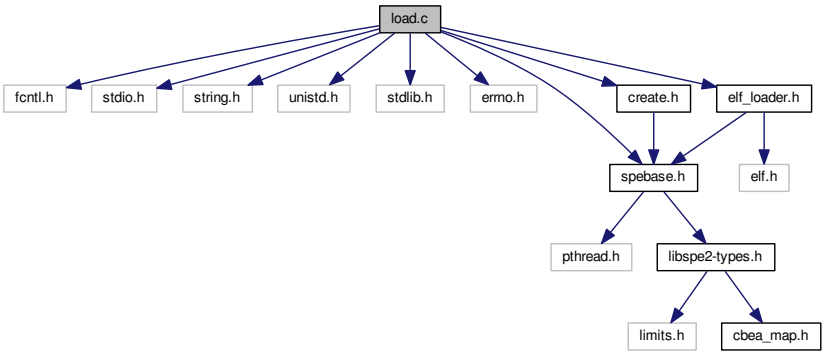
int spe_mfcio_tag_status_read (spe_context_ptr_t *spe*, unsigned int *mask*, unsigned int *behavior*, unsigned int * *tag_status*)

int spe_mssync_start (spe_context_ptr_t *spe*)

int spe_mssync_status (spe_context_ptr_t *spe*)

int spe_out_intr_mbox_read (spe_context_ptr_t *spe*, unsigned int * *mbox_data*, int *count*, unsigned int *behavior*)

Include dependency graph for load.c:



Macros

- #define SPE_EMULATED_LOADER_FILE "/usr/lib/spe/emulated-loader.bin"

Functions

- void _base_spe_program_load_complete (spe_context_ptr_t spectx)
- int _base_spe_emulated_loader_present (void)
- int _base_spe_program_load (spe_context_ptr_t spe, spe_program_handle_t *program)

3.18.1 Macro Definition Documentation

#define SPE_EMULATED_LOADER_FILE "/usr/lib/spe/emulated-loader.bin"

Definition at line 31 of file load.c.

3.18.2 Function Documentation

int _base_spe_emulated_loader_present (void)

Check if the emulated loader is present in the filesystem

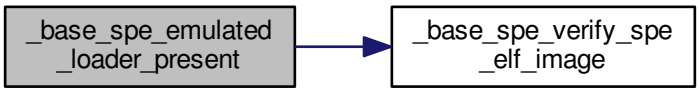
Returns

Non-zero if the loader is available, otherwise zero.

Definition at line 159 of file load.c.
References _base_spe_verify_spe_elf_image().
Referenced by _base_spe_context_create().

```
160 {
161         spe_program_handle_t *loader = emulated_loader_program();
162
163         if (!loader)
164                 return 0;
165
166         return !_base_spe_verify_spe_elf_image(loader);
167 }
```

Here is the call graph for this function:



int _base_spe_program_load (spe_context_ptr_t *spectx*, spe_program_handle_t * *program*)

_base_spe_program_load loads an ELF image into a context

Parameters

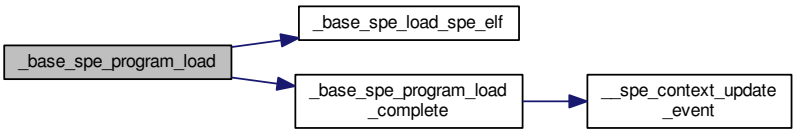
spectx	Specifies the SPE context
program	handle to the ELF image

Definition at line 203 of file load.c.

References _base_spe_load_spe_elf(), _base_spe_program_load_complete(), spe_context::base_private, DEBUG_PRINTF, spe_context_base_priv::emulated_entry, spe_ld_info::entry, spe_context_base_priv::entry, spe_context_base_priv::flags, spe_context_base_priv::loaded_program, spe_context_base_priv::mem_mmap_base, SPE_ISOLATE, and SPE_ISOLATE_EMULATE.

```
204 {
205         int rc = 0;
206         struct spe_ld_info ld_info;
207
208         spe->base_private->loaded_program = program;
209
210         if (spe->base_private->flags & SPE_ISOLATE) {
211                 rc = spe_start_isolated_app(spe, program);
212
213         } else if (spe->base_private->flags &
    SPE_ISOLATE_EMULATE) {
214                 rc = spe_start_emulated_isolated_app(spe, program, &ld_info);
215
216         } else {
217                 rc = _base_spe_load_spe_elf(program,
218                                 spe->base_private->mem_mmap_base, &ld_info);
219                 if (!rc)
220                         _base_spe_program_load_complete(spe);
221         }
222
223         if (rc != 0) {
224                 DEBUG_PRINTF ("Load SPE ELF failed..\n");
225                 return -1;
226         }
227
228         spe->base_private->entry = ld_info.entry;
229         spe->base_private->emulated_entry = ld_info.entry;
230
231         return 0;
232 }
```

Here is the call graph for this function:



void _base_spe_program_load_complete (spe_context_ptr_t *spectx*)

Register the SPE program's start address with the oprofile and gdb, by writing to the object-id file.

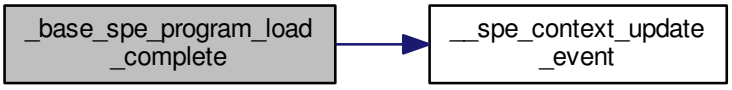
Definition at line 38 of file load.c.

References __spe_context_update_event(), spe_context::base_private, DEBUG_PRINTF, spe_program_handle::elf_image, spe_context_base_priv::fd_spe_dir, and spe_context_base_priv::loaded_program.

Referenced by _base_spe_context_run(), and _base_spe_program_load().

```
39 {
40         int objfd, len;
41         char buf[20];
42         spe_program_handle_t *program;
43
44         program = spectx->base_private->loaded_program;
45
46         if (!program || !program->elf_image) {
47                 DEBUG_PRINTF("%s called, but no program loaded\n", __func__);
48                 return;
49         }
50
51         objfd = openat(spectx->base_private->fd_spe_dir, "object-id", O_RDWR);
52         if (objfd < 0)
53                 return;
54
55         len = sprintf(buf, "%p", program->elf_image);
56         write(objfd, buf, len + 1);
57         close(objfd);
58
59         __spe_context_update_event();
60 }
```

Here is the call graph for this function:

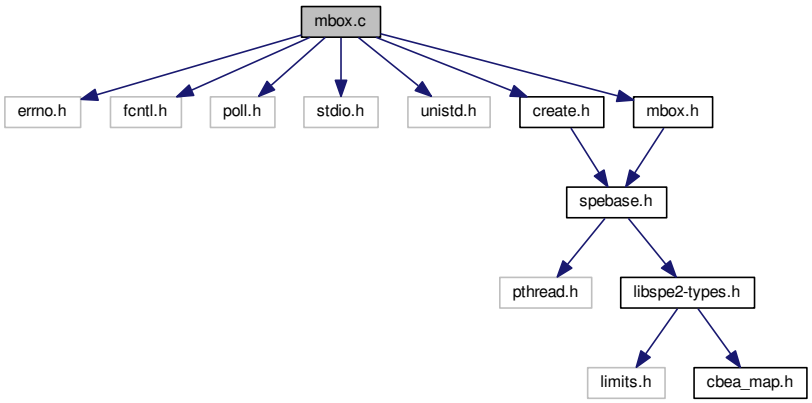


3.19 mbox.c File Reference

```
#include <errno.h>
```

```
#include <fcntl.h>
#include <poll.h>
#include <stdio.h>
#include <unistd.h>
#include "create.h"
#include "mbox.h"
```

Include dependency graph for mbox.c:



Functions

- int _base_spe_out_mbox_read (spe_context_ptr_t spectx, unsigned int mbox_data[ ], int count)
- int _base_spe_in_mbox_write (spe_context_ptr_t spectx, unsigned int *mbox_data, int count, int behavior_flag)
- int _base_spe_in_mbox_status (spe_context_ptr_t spectx)
- int _base_spe_out_mbox_status (spe_context_ptr_t spectx)
- int _base_spe_out_intr_mbox_status (spe_context_ptr_t spectx)
- int _base_spe_out_intr_mbox_read (spe_context_ptr_t spectx, unsigned int mbox_data[ ], int count, int behavior_flag)
- int _base_spe_signal_write (spe_context_ptr_t spectx, unsigned int signal_reg, unsigned int data)

3.19.1 Function Documentation

int _base_spe_in_mbox_status (spe_context_ptr_t *spectx*)

The _base_spe_in_mbox_status function fetches the status of the SPU inbound mailbox for the SPE thread specified by the speid parameter. A 0 value is return if the mailbox is full. A non-zero value specifies the number of available (32-bit) mailbox entries.

Parameters

spectx	Specifies the SPE context whose mailbox status is to be read.

Returns

On success, returns the current status of the mailbox, respectively. On failure, -1 is returned.

See Also

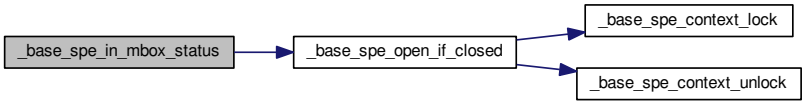
spe_read_out_mbox, spe_write_in_mbox, read (2)

Definition at line 202 of file mbox.c.

References _base_spe_open_if_closed(), spe_context::base_private, spe_context_base_priv::cntl_mmap_base, FD_WBOX_STAT, spe_context_base_priv::flags, SPE_MAP_PS, and spe_spu_control_area::SPU_Mbox_Stat.

```
203 {
204         int rc, ret;
205         volatile struct spe_spu_control_area *cntl_area =
206                 spectx->base_private->cntl_mmap_base;
207
208         if (spectx->base_private->flags & SPE_MAP_PS) {
209                 ret = (cntl_area->SPU_Mbox_Stat >> 8) & 0xFF;
210         } else {
211                 rc = read(_base_spe_open_if_closed(spectx,
    FD_WBOX_STAT, 0), &ret, 4);
212                 if (rc != 4)
213                         ret = -1;
214         }
215
216         return ret;
217
218 }
```

Here is the call graph for this function:



int _base_spe_in_mbox_write (spe_context_ptr_t *spectx*, unsigned int * *mbox_data*, int *count*, int *behavior_flag*)

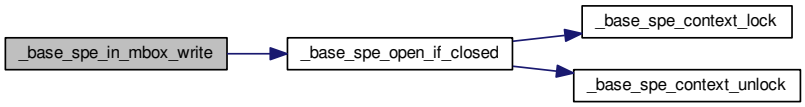
Definition at line 112 of file mbox.c.

References _base_spe_open_if_closed(), spe_context::base_private, FD_WBOX, FD_WBOX_NB, spe_context_base_priv::flags, SPE_MAP_PS, SPE_MBOX_ALL_BLOCKING, SPE_MBOX_ANY_BLOCKING, and SPE_MBOX_ANY_NONBLOCKING.

```
116 {
117         int rc;
118         int total;
119         unsigned int *aux;
120         struct pollfd fds;
121
122         if (mbox_data == NULL || count < 1){
123                 errno = EINVAL;
124                 return -1;
125         }
126
127         switch (behavior_flag) {
128         case SPE_MBOX_ALL_BLOCKING: // write all, even if blocking
129                 total = rc = 0;
130                 if (spectx->base_private->flags & SPE_MAP_PS) {
131                         do {
132                                 aux = mbox_data + total;
133                                 total += _base_spe_in_mbox_write_ps(spectx, aux, count - total);
134                                 if (total < count) { // we could not write everything, wait for space
135                                         fds.fd = _base_spe_open_if_closed(spectx,
    FD_WBOX, 0);
```

```
136                                         fds.events = POLLOUT;
137                                         rc = poll(&fds, 1, -1);
138                                         if (rc == -1 )
139                                                 return -1;
140                                 }
141                         } while (total < count);
142                 } else {
143                         while (total < 4*count) {
144                                 rc = write(_base_spe_open_if_closed(spectx,
    FD_WBOX, 0),
145                                            (const char *)mbox_data + total, 4*count - total);
146                                 if (rc == -1) {
147                                         break;
148                                 }
149                                 total += rc;
150                         }
151                         total /=4;
152                 }
153                 break;
154
155         case  SPE_MBOX_ANY_BLOCKING: // write at least one, even if blocking
156                 total = rc = 0;
157                 if (spectx->base_private->flags & SPE_MAP_PS) {
158                         do {
159                                 total = _base_spe_in_mbox_write_ps(spectx, mbox_data, count);
160                                 if (total == 0) { // we could not anything, wait for space
161                                         fds.fd = _base_spe_open_if_closed(spectx,
    FD_WBOX, 0);
162                                         fds.events = POLLOUT;
163                                         rc = poll(&fds, 1, -1);
164                                         if (rc == -1 )
165                                                 return -1;
166                                 }
167                         } while (total == 0);
168                 } else {
169                         rc = write(_base_spe_open_if_closed(spectx,
    FD_WBOX, 0), mbox_data, 4*count);
170                         total = rc/4;
171                 }
172                 break;
173
174         case  SPE_MBOX_ANY_NONBLOCKING: // only write, if non blocking
175                 total = rc = 0;
176                 // write directly if we map the PS else write via spufs
177                 if (spectx->base_private->flags & SPE_MAP_PS) {
178                         total = _base_spe_in_mbox_write_ps(spectx, mbox_data, count);
179                 } else {
180                         rc = write(_base_spe_open_if_closed(spectx,
    FD_WBOX_NB, 0), mbox_data, 4*count);
181                         if (rc == -1 && errno == EAGAIN) {
182                                 rc = 0;
183                                 errno = 0;
184                         }
185                         total = rc/4;
186                 }
187                 break;
188
189         default:
190                 errno = EINVAL;
191                 return -1;
192         }
193
194         if (rc == -1) {
195                 errno = EIO;
196                 return -1;
197         }
198
199         return total;
200 }
```

Here is the call graph for this function:



int _base_spe_out_intr_mbox_read (spe_context_ptr_t *spectx*, unsigned int *mbox_data[ ]*, int *count*, int *behavior_flag*)

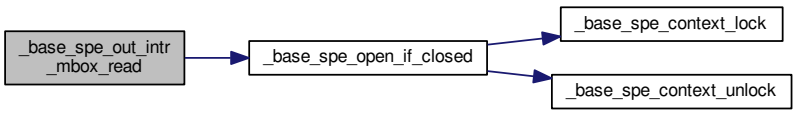
The _base_spe_out_intr_mbox_read function reads the contents of the SPE outbound interrupting mailbox for the SPE context.

Definition at line 255 of file mbox.c.

References _base_spe_open_if_closed(), FD_IBOX, FD_IBOX_NB, SPE_MBOX_ALL_BLOCKING, SPE_MBOX_ANY_BLOCKING, and SPE_MBOX_ANY_NONBLOCKING.

```
259 {
260         int rc;
261         int total;
262
263         if (mbox_data == NULL || count < 1){
264                 errno = EINVAL;
265                 return -1;
266         }
267
268         switch (behavior_flag) {
269         case SPE_MBOX_ALL_BLOCKING: // read all, even if blocking
270                 total = rc = 0;
271                 while (total < 4*count) {
272                         rc = read(_base_spe_open_if_closed(spectx,
    FD_IBOX, 0),
273                                   (char *)mbox_data + total, 4*count - total);
274                         if (rc == -1) {
275                                 break;
276                         }
277                         total += rc;
278                 }
279                 break;
280
281         case  SPE_MBOX_ANY_BLOCKING: // read at least one, even if blocking
282                 total = rc = read(_base_spe_open_if_closed(spectx,
    FD_IBOX, 0), mbox_data, 4*count);
283                 break;
284
285         case  SPE_MBOX_ANY_NONBLOCKING: // only reaad, if non blocking
286                 rc = read(_base_spe_open_if_closed(spectx,
    FD_IBOX_NB, 0), mbox_data, 4*count);
287                 if (rc == -1 && errno == EAGAIN) {
288                         rc = 0;
289                         errno = 0;
290                 }
291                 total = rc;
292                 break;
293
294         default:
295                 errno = EINVAL;
296                 return -1;
297         }
298
299         if (rc == -1) {
300                 errno = EIO;
301                 return -1;
302         }
303
304         return rc / 4;
305 }
```

Here is the call graph for this function:



int _base_spe_out_intr_mbox_status (spe_context_ptr_t *spectx*)

The _base_spe_out_intr_mbox_status function fetches the status of the SPU outbound interrupt mailbox for the SPE thread specified by the speid parameter. A 0 value is return if the mailbox is empty. A non-zero value specifies the number of 32-bit unread mailbox entries.

Parameters

spectx	Specifies the SPE context whose mailbox status is to be read.

Returns

On success, returns the current status of the mailbox, respectively. On failure, -1 is returned.

See Also

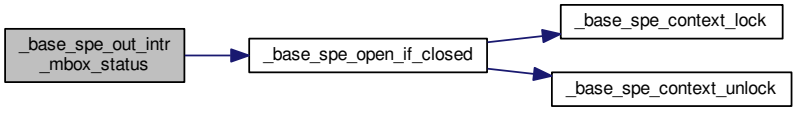
spe_read_out_mbox, spe_write_in_mbox, read (2)

Definition at line 238 of file mbox.c.

References _base_spe_open_if_closed(), spe_context::base_private, spe_context_base_priv::cntl_mmap_base, FD_IBOX_STAT, spe_context_base_priv::flags, SPE_MAP_PS, and spe_spu_control_area::SPU_Mbox_Stat.

```
239 {
240         int rc, ret;
241         volatile struct spe_spu_control_area *cntl_area =
242                 spectx->base_private->cntl_mmap_base;
243
244         if (spectx->base_private->flags & SPE_MAP_PS) {
245                 ret = (cntl_area->SPU_Mbox_Stat >> 16) & 0xFF;
246         } else {
247                 rc = read(_base_spe_open_if_closed(spectx,
      FD_IBOX_STAT, 0), &ret, 4);
248                 if (rc != 4)
249                         ret = -1;
250
251         }
252         return ret;
253 }
```

Here is the call graph for this function:



int _base_spe_out_mbox_read (spe_context_ptr_t *spectx*, unsigned int *mbox_data[ ]*, int *count*)

The _base_spe_out_mbox_read function reads the contents of the SPE outbound interrupting mailbox for the SPE thread speid.

The call will not block until the read request is satisfied, but instead return up to count currently available mailbox entries.

spe_stat_out_intr_mbox can be called to ensure that data is available prior to reading the outbound interrupting mailbox.

Parameters

spectx	Specifies the SPE thread whose outbound mailbox is to be read.
mbox_data	
count	

Return values

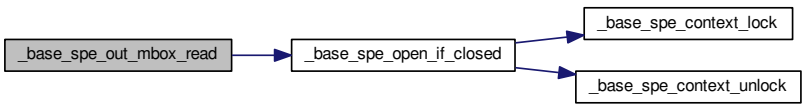
>0	the number of 32-bit mailbox messages read
=0	no data available
-1	error condition and errno is set Possible values for errno: EINVAL speid is invalid Exxxx what else do we need here??

Definition at line 58 of file mbox.c.

References _base_spe_open_if_closed(), spe_context::base_private, DEBUG_PRINTF, FD_MBOX, spe_context_base_priv::flags, and SPE_MAP_PS.

```
61 {
62         int rc;
63
64         if (mbox_data == NULL || count < 1){
65                 errno = EINVAL;
66                 return -1;
67         }
68
69         if (spectx->base_private->flags & SPE_MAP_PS) {
70                 rc = _base_spe_out_mbox_read_ps(spectx, mbox_data, count);
71         } else {
72                 rc = read(_base_spe_open_if_closed(spectx,
    FD_MBOX, 0), mbox_data, count*4);
73                 DEBUG_PRINTF("%s read rc: %d\n", __FUNCTION__, rc);
74                 if (rc != -1) {
75                         rc /= 4;
76                 } else {
77                         if (errno == EAGAIN ) { // no data ready to be read
78                                 errno = 0;
79                                 rc = 0;
80                         }
81                 }
82         }
83         return rc;
84 }
```

Here is the call graph for this function:



int _base_spe_out_mbox_status (spe_context_ptr_t *spectx*)

The _base_spe_out_mbox_status function fetches the status of the SPU outbound mailbox for the SPE thread specified by the speid parameter. A 0 value is return if the mailbox is empty. A non-zero value specifies the number of 32-bit unread mailbox entries.

Parameters

spectx	Specifies the SPE context whose mailbox status is to be read.

Returns

On success, returns the current status of the mailbox, respectively. On failure, -1 is returned.

See Also

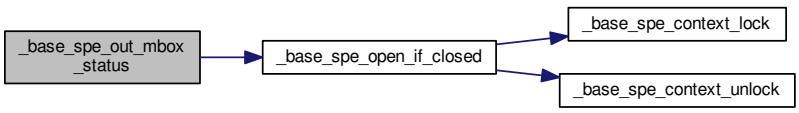
spe_read_out_mbox, spe_write_in_mbox, read (2)

Definition at line 220 of file mbox.c.

References _base_spe_open_if_closed(), spe_context::base_private, spe_context_base_priv::cntl_mmap_base, FD_MBOX_STAT, spe_context_base_priv::flags, SPE_MAP_PS, and spe_spu_control_area::SPU_Mbox_Stat.

```
221 {
222         int rc, ret;
223         volatile struct spe_spu_control_area *cntl_area =
224                 spectx->base_private->cntl_mmap_base;
225
226         if (spectx->base_private->flags & SPE_MAP_PS) {
227                 ret = cntl_area->SPU_Mbox_Stat & 0xFF;
228         } else {
229                 rc = read(_base_spe_open_if_closed(spectx,
    FD_MBOX_STAT, 0), &ret, 4);
230                 if (rc != 4)
231                         ret = -1;
232         }
233
234         return ret;
235
236 }
```

Here is the call graph for this function:



int _base_spe_signal_write (spe_context_ptr_t *spectx*, unsigned int *signal_reg*, unsigned int *data*)

The _base_spe_signal_write function writes data to the signal notification register specified by signal_reg for the SPE thread specified by the speid parameter.

Parameters

spectx	Specifies the SPE context whose signal register is to be written to.
signal_reg	Specified the signal notification register to be written. Valid signal notification registers are: SPE_SIG_NOTIFY_REG_1 SPE signal notification register 1 SPE_SIG_NOTIFY_REG_2 SPE signal notification register 2
data	The 32-bit data to be written to the specified signal notification register.

Returns

On success, spe_write_signal returns 0. On failure, -1 is returned.

See Also

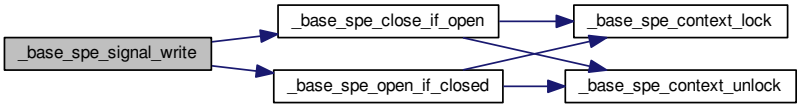
spe_get_ps_area, spe_write_in_mbox

Definition at line 307 of file mbox.c.

References _base_spe_close_if_open(), _base_spe_open_if_closed(), spe_context::base_private, FD_SIG1, FD_SIG2, spe_context_base_priv::flags, spe_context_base_priv::signal1_mmap_base, spe_context_base_priv::signal2_mmap_base, SPE_MAP_PS, SPE_SIG_NOTIFY_REG_1, SPE_SIG_NOTIFY_REG_2, spe_sig_notify_1_area::SPU_Sig_Notify_1, and spe_sig_notify_2_area::SPU_Sig_Notify_2.

```
310 {
311         int rc;
312
313         if (spectx->base_private->flags & SPE_MAP_PS) {
314                 if (signal_reg == SPE_SIG_NOTIFY_REG_1) {
315                         spe_sig_notify_1_area_t *sig = spectx->
    base_private->signal1_mmap_base;
316
317                         sig->SPU_Sig_Notify_1 = data;
318                 } else if (signal_reg == SPE_SIG_NOTIFY_REG_2) {
319                         spe_sig_notify_2_area_t *sig = spectx->
    base_private->signal2_mmap_base;
320
321                         sig->SPU_Sig_Notify_2 = data;
322                 } else {
323                         errno = EINVAL;
324                         return -1;
325                 }
326                 rc = 0;
327         } else {
328                 if (signal_reg == SPE_SIG_NOTIFY_REG_1)
329                         rc = write(_base_spe_open_if_closed(spectx,
    FD_SIG1, 0), &data, 4);
330                 else if (signal_reg == SPE_SIG_NOTIFY_REG_2)
331                         rc = write(_base_spe_open_if_closed(spectx,
    FD_SIG2, 0), &data, 4);
332                 else {
333                         errno = EINVAL;
334                         return -1;
335                 }
336
337                 if (rc == 4)
338                         rc = 0;
339
340                 if (signal_reg == SPE_SIG_NOTIFY_REG_1)
341                         _base_spe_close_if_open(spectx,
    FD_SIG1);
342                 else if (signal_reg == SPE_SIG_NOTIFY_REG_2)
343                         _base_spe_close_if_open(spectx,
    FD_SIG2);
344         }
345
346         return rc;
347 }
```

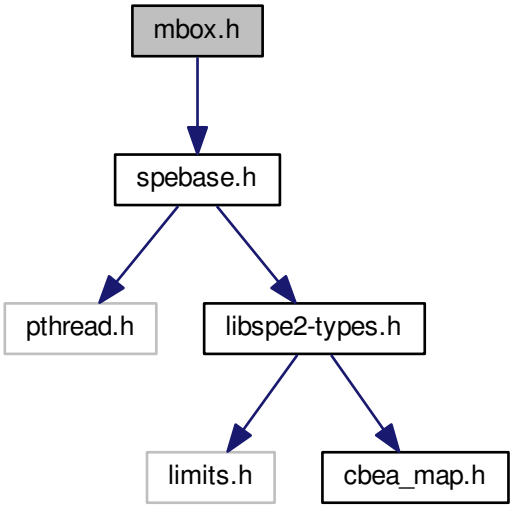
Here is the call graph for this function:



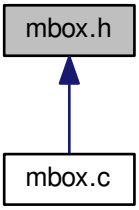
3.20 mbox.h File Reference

```
#include "spebase.h"
```

Include dependency graph for mbox.h:



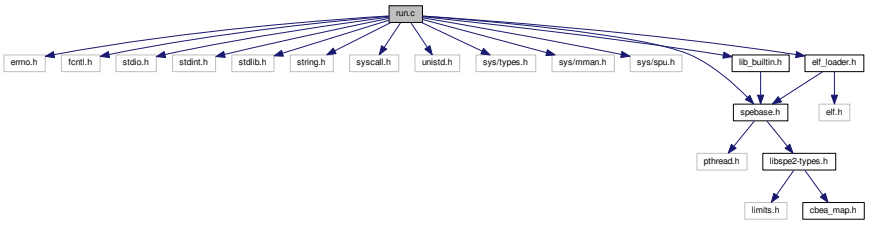
This graph shows which files directly or indirectly include this file:



3.21 run.c File Reference

```
#include <errno.h>
#include <fcntl.h>
#include <stdio.h>
#include <stdint.h>
#include <stdlib.h>
#include <string.h>
#include <syscall.h>
#include <unistd.h>
#include <sys/types.h>
#include <sys/mman.h>
#include <sys/spu.h>
#include "elf_loader.h"
#include "lib_builtin.h"
#include "spebase.h"
```

Include dependency graph for run.c:



Data Structures

- struct spe_context_info

Macros

- #define GNU_SOURCE 1

Functions

- int _base_spe_context_run (spe_context_ptr_t spe, unsigned int *entry, unsigned int runflags, void *argp, void *envp, spe_stop_info_t *stopinfo)

Variables

- __thread struct spe_context_info * __spe_current_active_context

3.21.1 Macro Definition Documentation

#define GNU_SOURCE 1

Definition at line 20 of file run.c.

3.21.2 Function Documentation

int _base_spe_context_run (spe_context_ptr_t *spe,* unsigned int * *entry,* unsigned int *runflags,* void * *argp,* void * *envp,* spe_stop_info_t * *stopinfo*)

_base_spe_context_run starts execution of an SPE context with a loaded image
Parameters

spectx	Specifies the SPE context
entry	entry point for the SPE programm. If set to 0, entry point is determined by the ELF loader.
runflags	valid values are: SPE_RUN_USER_REGS Specifies that the SPE setup registers r3, r4, and r5 are initialized with the 48 bytes pointed to by argp. SPE_NO_CALLBACKS do not use built in library functions.
argp	An (optional) pointer to application specific data, and is passed as the second parameter to the SPE program.
envp	An (optional) pointer to environment specific data, and is passed as the third parameter to the SPE program.

Definition at line 99 of file run.c.

References __spe_current_active_context, _base_spe_handle_library_callback(), _base_spe_program_load_complete(), spe_context::base_private, DEBUG_PRINTF, spe_context_base_priv::emulated_entry, spe_context_base_priv::entry, spe_context_base_priv::fd_spe_dir, spe_context_base_priv::flags, LS_SIZE, spe_context_base_priv::mem_mmap_base, spe_context_info::npc, spe_context_info::prev, spe_stop_info::result, spe_stop_info::spe_callback_error, SPE_CALLBACK_ERROR, SPE_DEFAULT_ENTRY, SPE_EVENTS_ENABLE, SPE_EXIT, spe_stop_info::spe_exit_code, spe_context_info::spe_id, SPE_ISOLATE, SPE_ISOLATE_EMULATE, spe_stop_info::spe_isolation_error, SPE_ISOLATION_ERROR, SPE_NO_CALLBACKS, SPE_PROGRAM_ISO_LOAD_COMPLETE, SPE_PROGRAM_ISOLATED_STOP, SPE_PROGRAM_LIBRARY_CALL, SPE_PROGRAM_NORMAL_END, SPE_RUN_USER_REGS, spe_stop_info::spe_runtime_error, SPE_RUNTIME_ERROR, spe_stop_info::spe_runtime_exception, SPE_RUNTIME_EXCEPTION, spe_stop_info::spe_runtime_fatal, SPE_RUNTIME_FATAL, spe_stop_info::spe_signal_code, SPE_SPU_HALT, SPE_SPU_INVALID_CHANNEL, SPE_SPU_INVALID_INSTR, SPE_SPU_STOPPED_BY_STOP, SPE_SPU_WAITING_ON_CHANNEL, SPE_STOP_AND_SIGNAL, spe_stop_info::spu_status, spe_context_info::status, spe_stop_info::stop_reason, addr64::ui, and addr64::ull.

Referenced by _event_spe_context_run().

```
102 {
103         int retval = 0, run_rc;
104         unsigned int run_status, tmp_entry;
105         spe_stop_info_t  stopinfo_buf;
106         struct spe_context_info this_context_info __attribute__((cleanup(
```

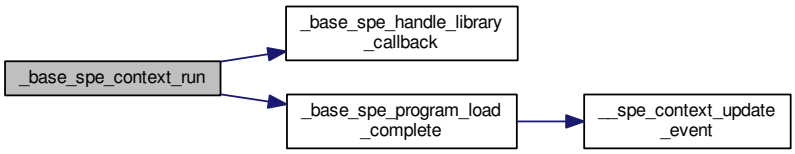
```
    cleanupspeinfo)));
107
108         /* If the caller hasn't set a stopinfo buffer, provide a buffer on the
109          * stack instead. */
110         if (!stopinfo)
111                 stopinfo = &stopinfo_buf;
112
113
114         /* In emulated isolated mode, the npc will always return as zero.
115          * use our private entry point instead */
116         if (spe->base_private->flags & SPE_ISOLATE_EMULATE)
117                 tmp_entry = spe->base_private->emulated_entry;
118
119         else if (*entry == SPE_DEFAULT_ENTRY)
120                 tmp_entry = spe->base_private->entry;
121         else
122                 tmp_entry = *entry;
123
124         /* If we're starting the SPE binary from its original entry point,
125          * setup the arguments to main() */
126         if (tmp_entry == spe->base_private->entry &&
127                         !(spe->base_private->flags &
128                                 (SPE_ISOLATE | SPE_ISOLATE_EMULATE))) {
129
130                 addr64 argp64, envp64, tid64, ls64;
131                 unsigned int regs[128][4];
132
133                 /* setup parameters */
134                 argp64.ull = (uint64_t)(unsigned long)argp;
135                 envp64.ull = (uint64_t)(unsigned long)envp;
136                 tid64.ull = (uint64_t)(unsigned long)spe;
137
138                 /* make sure the register values are 0 */
139                 memset(regs, 0, sizeof(regs));
140
141                 /* set sensible values for stack_ptr and stack_size */
142                 regs[1][0] = (unsigned int) LS_SIZE - 16;        /* stack_ptr */
143                 regs[2][0] = 0;                                                 /* stack_size ( 0 =
    default ) */
144
145                 if (runflags & SPE_RUN_USER_REGS) {
146                         /* When SPE_USER_REGS is set, argp points to an array
147                          * of 3x128b registers to be passed directly to the SPE
148                          * program.
149                          */
150                         memcpy(regs[3], argp, sizeof(unsigned int) * 12);
151                 } else {
152                         regs[3][0] = tid64.ui[0];
153                         regs[3][1] = tid64.ui[1];
154
155                         regs[4][0] = argp64.ui[0];
156                         regs[4][1] = argp64.ui[1];
157
158                         regs[5][0] = envp64.ui[0];
159                         regs[5][1] = envp64.ui[1];
160                 }
161
162                 /* Store the LS base address in R6 */
163                 ls64.ull = (uint64_t)(unsigned long)spe->base_private->
    mem_mmap_base;
164                 regs[6][0] = ls64.ui[0];
165                 regs[6][1] = ls64.ui[1];
166
167                 if (set_regs(spe, regs))
168                         return -1;
169         }
170
171         /*Leave a trail of breadcrumbs for the debugger to follow */
172         if (!__spe_current_active_context) {
173                 __spe_current_active_context = &this_context_info;
174                 if (!__spe_current_active_context)
175                         return -1;
176                 __spe_current_active_context->prev = NULL;
177         } else {
178                 struct spe_context_info *newinfo;
179                 newinfo = &this_context_info;
180                 if (!newinfo)
181                         return -1;
182                 newinfo->prev = __spe_current_active_context;
183                 __spe_current_active_context = newinfo;
```

```
184         }
185         /*remember the ls-addr*/
186         __spe_current_active_context->spe_id = spe->
    base_private->fd_spe_dir;
187
188 do_run:
189         /*Remember the npc value*/
190         __spe_current_active_context->npc = tmp_entry;
191
192         /* run SPE context */
193         run_rc = spu_run(spe->base_private->fd_spe_dir,
194                          &tmp_entry, &run_status);
195
196         /*Remember the npc value*/
197         __spe_current_active_context->npc = tmp_entry;
198         __spe_current_active_context->status = run_status;
199
200         DEBUG_PRINTF("spu_run returned run_rc=0x%08x, entry=0x%04x, "
201                          "ext_status=0x%04x.\n", run_rc, tmp_entry, run_status);
202
203         /* set up return values and stopinfo according to spu_run exit
204          * conditions. This is overwritten on error.
205          */
206         stopinfo->spu_status = run_rc;
207
208         if (spe->base_private->flags & SPE_ISOLATE_EMULATE) {
209                 /* save the entry point, and pretend that the npc is zero */
210                 spe->base_private->emulated_entry = tmp_entry;
211                 *entry = 0;
212         } else {
213                 *entry = tmp_entry;
214         }
215
216         /* Return with stopinfo set on syscall error paths */
217         if (run_rc == -1) {
218                 DEBUG_PRINTF("spu_run returned error %d, errno=%d\n",
219                                  run_rc, errno);
220                 stopinfo->stop_reason = SPE_RUNTIME_FATAL;
221                 stopinfo->result.spe_runtime_fatal = errno;
222                 retval = -1;
223
224                 /* For isolated contexts, pass EPERM up to the
225                  * caller.
226                  */
227                 if (!(spe->base_private->flags & SPE_ISOLATE
228                                  && errno == EPERM))
229                         errno = EFAULT;
230
231         } else if (run_rc & SPE_SPU_INVALID_INSTR) {
232                 DEBUG_PRINTF("SPU has tried to execute an invalid "
233                                  "instruction. %d\n", run_rc);
234                 stopinfo->stop_reason = SPE_RUNTIME_ERROR;
235                 stopinfo->result.spe_runtime_error =
    SPE_SPU_INVALID_INSTR;
236                 errno = EFAULT;
237                 retval = -1;
238
239         } else if ((spe->base_private->flags &
    SPE_EVENTS_ENABLE) && run_status) {
240                 /* Report asynchronous error if return val are set and
241                  * SPU events are enabled.
242                  */
243                 stopinfo->stop_reason = SPE_RUNTIME_EXCEPTION;
244                 stopinfo->result.spe_runtime_exception = run_status;
245                 stopinfo->spu_status = -1;
246                 errno = EIO;
247                 retval = -1;
248
249         } else if (run_rc & SPE_SPU_STOPPED_BY_STOP) {
250                 /* Stop & signals are broken down into three groups
251                  *  1. SPE library call
252                  *  2. SPE user defined stop & signal
253                  *  3. SPE program end.
254                  *
255                  * These groups are signified by the 14-bit stop code:
256                  */
257                 int stopcode = (run_rc >> 16) & 0x3fff;
258
259                 /* Check if this is a library callback, and callbacks are
260                  * allowed (ie, running without SPE_NO_CALLBACKS)
```

```
261                 */
262                if ((stopcode & 0xff00) == SPE_PROGRAM_LIBRARY_CALL
263                                && !(runflags & SPE_NO_CALLBACKS)) {
264
265                        int callback_rc, callback_number = stopcode & 0xff;
266
267                        /* execute library callback */
268                        DEBUG_PRINTF("SPE library call: %d\n", callback_number);
269                        callback_rc = _base_spe_handle_library_callback(
    spe,
270                                                                        callback_number, *entry);
271
272                        if (callback_rc) {
273                                /* library callback failed; set errno and
274                                 * return immediately */
275                                DEBUG_PRINTF("SPE library call failed: %d\n",
276                                                callback_rc);
277                                stopinfo->stop_reason =
    SPE_CALLBACK_ERROR;
278                                stopinfo->result.spe_callback_error =
279                                        callback_rc;
280                                errno = EFAULT;
281                                retval = -1;
282                        } else {
283                                /* successful library callback - restart the SPE
284                                 * program at the next instruction */
285                                tmp_entry += 4;
286                                goto do_run;
287                        }
288
289                } else if ((stopcode & 0xff00) == SPE_PROGRAM_NORMAL_END) {
290                        /* The SPE program has exited by exit(X) */
291                        stopinfo->stop_reason = SPE_EXIT;
292                        stopinfo->result.spe_exit_code = stopcode & 0xff;
293
294                        if (spe->base_private->flags &
    SPE_ISOLATE) {
295                                /* Issue an isolated exit, and re-run the SPE.
296                                 * We should see a return value without the
297                                 * 0x80 bit set. */
298                                if (!issue_isolated_exit(spe))
299                                        goto do_run;
300                                retval = -1;
301                        }
302
303                } else if ((stopcode & 0xfff0) == SPE_PROGRAM_ISOLATED_STOP) {
304
305                        /* 0x2206: isolated app has been loaded by loader;
306                         * provide a hook for the debugger to catch this,
307                         * and restart
308                         */
309                        if (stopcode == SPE_PROGRAM_ISO_LOAD_COMPLETE) {
310                                _base_spe_program_load_complete(spe);
311                                goto do_run;
312                        } else {
313                                stopinfo->stop_reason =
    SPE_ISOLATION_ERROR;
314                                stopinfo->result.spe_isolation_error =
315                                        stopcode & 0xf;
316                        }
317
318                } else if (spe->base_private->flags &
    SPE_ISOLATE &&
319                                !(run_rc & 0x80)) {
320                        /* We've successfully exited isolated mode */
321                        retval = 0;
322
323                } else {
324                        /* User defined stop & signal, including
325                         * callbacks when disabled */
326                        stopinfo->stop_reason = SPE_STOP_AND_SIGNAL;
327                        stopinfo->result.spe_signal_code = stopcode;
328                        retval = stopcode;
329                }
330
331        } else if (run_rc & SPE_SPU_HALT) {
332                DEBUG_PRINTF("SPU was stopped by halt. %d\n", run_rc);
333                stopinfo->stop_reason = SPE_RUNTIME_ERROR;
334                stopinfo->result.spe_runtime_error =
    SPE_SPU_HALT;
```

```
335                 errno = EFAULT;
336                 retval = -1;
337
338         } else if (run_rc & SPE_SPU_WAITING_ON_CHANNEL) {
339                 DEBUG_PRINTF("SPU is waiting on channel. %d\n", run_rc);
340                 stopinfo->stop_reason = SPE_RUNTIME_EXCEPTION;
341                 stopinfo->result.spe_runtime_exception = run_status;
342                 stopinfo->spu_status = -1;
343                 errno = EIO;
344                 retval = -1;
345
346         } else if (run_rc & SPE_SPU_INVALID_CHANNEL) {
347                 DEBUG_PRINTF("SPU has tried to access an invalid "
348                                 "channel. %d\n", run_rc);
349                 stopinfo->stop_reason = SPE_RUNTIME_ERROR;
350                 stopinfo->result.spe_runtime_error =
    SPE_SPU_INVALID_CHANNEL;
351                 errno = EFAULT;
352                 retval = -1;
353
354         } else {
355                 DEBUG_PRINTF("spu_run returned invalid data: 0x%04x\n", run_rc);
356                 stopinfo->stop_reason = SPE_RUNTIME_FATAL;
357                 stopinfo->result.spe_runtime_fatal = -1;
358                 stopinfo->spu_status = -1;
359                 errno = EFAULT;
360                 retval = -1;
361
362         }
363
364         freespeinfo();
365         return retval;
366 }
```

Here is the call graph for this function:



3.21.3 Variable Documentation

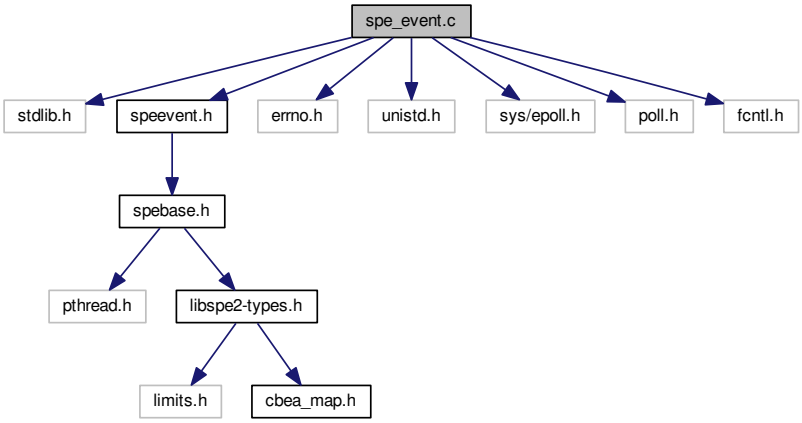
__thread struct spe_context_info* __spe_current_active_context

Referenced by _base_spe_context_run().

3.22 spe_event.c File Reference

```
#include <stdlib.h>
#include "speevent.h"
#include <errno.h>
#include <unistd.h>
#include <sys/epoll.h>
#include <poll.h>
#include <fcntl.h>
```

Include dependency graph for spe_event.c:



Macros

- #define __SPE_EVENT_ALL
- #define __SPE_EPOLL_SIZE 10
- #define __SPE_EPOLL_FD_GET(handler) (*(int*)(handler))
- #define __SPE_EPOLL_FD_SET(handler, fd) (*(int*)(handler) = (fd))
- #define __SPE_EVENT_CONTEXT_PRIV_GET(spe) ((spe_context_event_priv_ptr_t)(spe)->event_private)
- #define __SPE_EVENT_CONTEXT_PRIV_SET(spe, evctx) ((spe)->event_private = (evctx))
- #define __SPE_EVENTS_ENABLED(spe) ((spe)->base_private->flags & SPE_EVENTS_ENABLE)

Functions

- void _event_spe_context_lock (spe_context_ptr_t spe)
- void _event_spe_context_unlock (spe_context_ptr_t spe)
- int _event_spe_stop_info_read (spe_context_ptr_t spe, spe_stop_info_t *stopinfo)
- spe_event_handler_ptr_t _event_spe_event_handler_create (void)
- int _event_spe_event_handler_destroy (spe_event_handler_ptr_t evhandler)
- int _event_spe_event_handler_register (spe_event_handler_ptr_t evhandler, spe_event_unit_t *event)
- int _event_spe_event_handler_deregister (spe_event_handler_ptr_t evhandler, spe_event_unit_t *event)
- int _event_spe_event_wait (spe_event_handler_ptr_t evhandler, spe_event_unit_t *events, int max_events, int timeout)
- int _event_spe_context_finalize (spe_context_ptr_t spe)
- struct spe_context_event_priv * _event_spe_context_initialize (spe_context_ptr_t spe)
- int _event_spe_context_run (spe_context_ptr_t spe, unsigned int *entry, unsigned int runflags, void *argp, void *envp, spe_stop_info_t *stopinfo)

3.22.1 Macro Definition Documentation

#define __SPE_EPOLL_FD_GET(*handler*) (*(int*)(handler))

Definition at line 37 of file spe_event.c.
Referenced by _event_spe_event_handler_deregister(), _event_spe_event_handler_destroy(), _event_spe_event_handler_register(), and _event_spe_event_wait().

#define __SPE_EPOLL_FD_SET(*handler, fd*) (*(int*)(handler) = (fd))

Definition at line 38 of file spe_event.c.
Referenced by _event_spe_event_handler_create().

#define __SPE_EPOLL_SIZE 10

Definition at line 35 of file spe_event.c.
Referenced by _event_spe_event_handler_create().

#define __SPE_EVENT_ALL

Value:

```
( SPE_EVENT_OUT_INTR_MBOX | SPE_EVENT_IN_MBOX |
      \
    SPE_EVENT_TAG_GROUP | SPE_EVENT_SPE_STOPPED )
```

Definition at line 31 of file spe_event.c.
Referenced by _event_spe_event_handler_deregister(), and _event_spe_event_handler_register().

#define __SPE_EVENT_CONTEXT_PRIV_GET(*spe*) ((spe_context_event_priv_ptr_t)(spe)->event_private)

Definition at line 40 of file spe_event.c.
Referenced by _event_spe_context_finalize(), _event_spe_context_lock(), _event_spe_context_run(), _event_spe_context_unlock(), _event_spe_event_handler_deregister(), _event_spe_event_handler_register(), and _event_spe_stop_info_read().

#define __SPE_EVENT_CONTEXT_PRIV_SET(*spe, evctx*) ((spe)->event_private = (evctx))

Definition at line 42 of file spe_event.c.
Referenced by _event_spe_context_finalize().

#define __SPE_EVENTS_ENABLED(*spe*) ((spe)->base_private->flags & SPE_EVENTS_ENABLE)

Definition at line 45 of file spe_event.c.
Referenced by _event_spe_event_handler_deregister(), and _event_spe_event_handler_register().

3.22.2 Function Documentation

int _event_spe_context_finalize (spe_context_ptr_t *spe*)

Definition at line 416 of file spe_event.c.
References __SPE_EVENT_CONTEXT_PRIV_GET, __SPE_EVENT_CONTEXT_PRIV_SET, spe_context_event_priv::lock, spe_context_event_priv::stop_event_pipe, and spe_context_event_priv::stop_event_read_lock.

```
417 {
418   spe_context_event_priv_ptr_t evctx;
419
420   if (!spe) {
421     errno = ESRCH;
422     return -1;
423   }
424
425   evctx = __SPE_EVENT_CONTEXT_PRIV_GET(spe);
426   __SPE_EVENT_CONTEXT_PRIV_SET(spe, NULL);
427
428   close(evctx->stop_event_pipe[0]);
429   close(evctx->stop_event_pipe[1]);
430
431   pthread_mutex_destroy(&evctx->lock);
432   pthread_mutex_destroy(&evctx->stop_event_read_lock);
433
434   free(evctx);
435
436   return 0;
437 }
```

struct spe_context_event_priv* _event_spe_context_initialize (spe_context_ptr_t *spe*)

Definition at line 439 of file spe_event.c.

References spe_context_event_priv::events, spe_context_event_priv::lock, spe_event_unit::spe, spe_context_event_priv::stop_event_pipe, and spe_context_event_priv::stop_event_read_lock.

```
440 {
441   spe_context_event_priv_ptr_t evctx;
442   int rc;
443   int i;
444
445   evctx = calloc(1, sizeof(*evctx));
446   if (!evctx) {
447     return NULL;
448   }
449
450   rc = pipe(evctx->stop_event_pipe);
451   if (rc == -1) {
452     free(evctx);
453     return NULL;
454   }
455   rc = fcntl(evctx->stop_event_pipe[0], F_GETFL);
456   if (rc != -1) {
457     rc = fcntl(evctx->stop_event_pipe[0], F_SETFL, rc | O_NONBLOCK);
458   }
459   if (rc == -1) {
460     close(evctx->stop_event_pipe[0]);
461     close(evctx->stop_event_pipe[1]);
462     free(evctx);
463     errno = EIO;
464     return NULL;
465   }
466
467   for (i = 0; i < sizeof(evctx->events) / sizeof(evctx->events[0]); i++) {
468     evctx->events[i].spe = spe;
469   }
470
471   pthread_mutex_init(&evctx->lock, NULL);
472   pthread_mutex_init(&evctx->stop_event_read_lock, NULL);
473
474   return evctx;
475 }
```

void _event_spe_context_lock (spe_context_ptr_t *spe*)

Definition at line 49 of file spe_event.c.

References __SPE_EVENT_CONTEXT_PRIV_GET.

Referenced by _event_spe_event_handler_deregister(), _event_spe_event_handler_register(), and _event_spe_event_wait().

```
50 {
51   pthread_mutex_lock(&__SPE_EVENT_CONTEXT_PRIV_GET(spe)->lock);
52 }
```

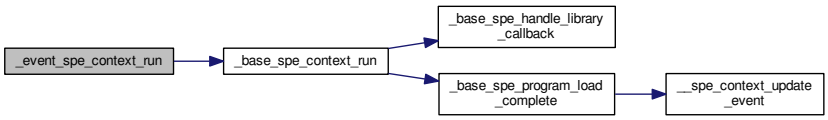
int _event_spe_context_run (spe_context_ptr_t *spe*, unsigned int * *entry*, unsigned int *runflags*, void * *argp*, void * *envp*, spe_stop_info_t * *stopinfo*)

Definition at line 477 of file spe_event.c.

References __SPE_EVENT_CONTEXT_PRIV_GET, _base_spe_context_run(), and spe_context_event_priv::stop_event_pipe.

```
478 {
479   spe_context_event_priv_ptr_t evctx;
480   spe_stop_info_t stopinfo_buf;
481   int rc;
482
483   if (!stopinfo) {
484     stopinfo = &stopinfo_buf;
485   }
486   rc = _base_spe_context_run(spe, entry, runflags, argp, envp, stopinfo);
487
488   evctx = __SPE_EVENT_CONTEXT_PRIV_GET(spe);
489   if (write(evctx->stop_event_pipe[1], stopinfo, sizeof(*stopinfo)) != sizeof(*stopinfo)) {
490     /* error check. */
491   }
492
493   return rc;
494 }
```

Here is the call graph for this function:



void _event_spe_context_unlock (spe_context_ptr_t *spe*)

Definition at line 54 of file spe_event.c.

References __SPE_EVENT_CONTEXT_PRIV_GET.

Referenced by _event_spe_event_handler_deregister(), _event_spe_event_handler_register(), and _event_spe_event_wait().

```
55 {
56   pthread_mutex_unlock(&__SPE_EVENT_CONTEXT_PRIV_GET(spe)->lock);
57 }
```

spe_event_handler_ptr_t _event_spe_event_handler_create (void)

Definition at line 110 of file spe_event.c.

References __SPE_EPOLL_FD_SET, and __SPE_EPOLL_SIZE.

```
111 {
112   int epfd;
113   spe_event_handler_t *evhandler;
114
115   evhandler = calloc(1, sizeof(*evhandler));
116   if (!evhandler) {
```

```
117     return NULL;
118   }
119
120   epfd = epoll_create(__SPE_EPOLL_SIZE);
121   if (epfd == -1) {
122     free(evhandler);
123     return NULL;
124   }
125
126   __SPE_EPOLL_FD_SET(evhandler, epfd);
127
128   return evhandler;
129 }
```

int _event_spe_event_handler_deregister (spe_event_handler_ptr_t *evhandler,* spe_event_unit_t * *event*)

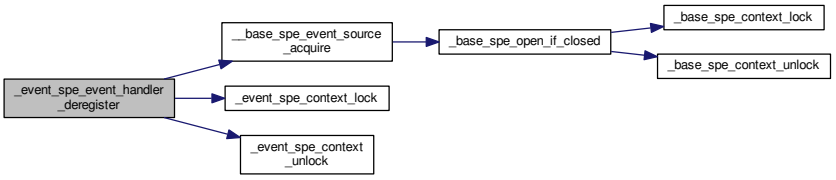
Definition at line 273 of file spe_event.c.

References __base_spe_event_source_acquire(), __SPE_EPOLL_FD_GET, __SPE_EVENT_ALL, __SPE_EVENT_CONTEXT_PRIV_GET, __SPE_EVENT_IN_MBOX, __SPE_EVENT_OUT_INTR_MBOX, __SPE_EVENT_SPE_STOPPED, __SPE_EVENT_TAG_GROUP, __SPE_EVENTS_ENABLED, _event_spe_context_lock(), _event_spe_context_unlock(), spe_context_event_priv::events, spe_event_unit::events, FD_IBOX, FD_MFC, FD_WBOX, spe_event_unit::spe, SPE_EVENT_IN_MBOX, SPE_EVENT_OUT_INTR_MBOX, SPE_EVENT_SPE_STOPPED, SPE_EVENT_TAG_GROUP, and spe_context_event_priv::stop_event_pipe.

```
274 {
275   int epfd;
276   const int ep_op = EPOLL_CTL_DEL;
277   spe_context_event_priv_ptr_t evctx;
278   int fd;
279
280   if (!evhandler) {
281     errno = ESRCH;
282     return -1;
283   }
284   if (!event || !event->spe) {
285     errno = EINVAL;
286     return -1;
287   }
288   if (!__SPE_EVENTS_ENABLED(event->spe)) {
289     errno = ENOTSUP;
290     return -1;
291   }
292
293   epfd = __SPE_EPOLL_FD_GET(evhandler);
294   evctx = __SPE_EVENT_CONTEXT_PRIV_GET(event->spe);
295
296   if (event->events & ~__SPE_EVENT_ALL) {
297     errno = ENOTSUP;
298     return -1;
299   }
300
301   _event_spe_context_lock(event->spe); /* for spe->event_private->events */
302
303   if (event->events & SPE_EVENT_OUT_INTR_MBOX) {
304     fd = __base_spe_event_source_acquire(event->
    spe, FD_IBOX);
305     if (fd == -1) {
306       _event_spe_context_unlock(event->spe);
307       return -1;
308     }
309     if (epoll_ctl(epfd, ep_op, fd, NULL) == -1) {
310       _event_spe_context_unlock(event->spe);
311       return -1;
312     }
313     evctx->events[__SPE_EVENT_OUT_INTR_MBOX].
    events = 0;
314   }
315
316   if (event->events & SPE_EVENT_IN_MBOX) {
317     fd = __base_spe_event_source_acquire(event->
    spe, FD_WBOX);
318     if (fd == -1) {
319       _event_spe_context_unlock(event->spe);
```

```
320       return -1;
321     }
322     if (epoll_ctl(epfd, ep_op, fd, NULL) == -1) {
323       _event_spe_context_unlock(event->spe);
324       return -1;
325     }
326     evctx->events[__SPE_EVENT_IN_MBOX].events = 0;
327   }
328
329   if (event->events & SPE_EVENT_TAG_GROUP) {
330     fd = __base_spe_event_source_acquire(event->
    spe, FD_MFC);
331     if (fd == -1) {
332       _event_spe_context_unlock(event->spe);
333       return -1;
334     }
335     if (epoll_ctl(epfd, ep_op, fd, NULL) == -1) {
336       _event_spe_context_unlock(event->spe);
337       return -1;
338     }
339     evctx->events[__SPE_EVENT_TAG_GROUP].events = 0;
340   }
341
342   if (event->events & SPE_EVENT_SPE_STOPPED) {
343     fd = evctx->stop_event_pipe[0];
344     if (epoll_ctl(epfd, ep_op, fd, NULL) == -1) {
345       _event_spe_context_unlock(event->spe);
346       return -1;
347     }
348     evctx->events[__SPE_EVENT_SPE_STOPPED].events = 0;
349   }
350
351   _event_spe_context_unlock(event->spe);
352
353   return 0;
354 }
```

Here is the call graph for this function:



int _event_spe_event_handler_destroy (spe_event_handler_ptr_t *evhandler*)

Definition at line 135 of file spe_event.c.
References __SPE_EPOLL_FD_GET.

```
136 {
137   int epfd;
138
139   if (!evhandler) {
140     errno = ESRCH;
141     return -1;
142   }
143
144   epfd = __SPE_EPOLL_FD_GET(evhandler);
145   close(epfd);
146
147   free(evhandler);
148   return 0;
149 }
```

int _event_spe_event_handler_register (spe_event_handler_ptr_t *evhandler*, spe_event_unit_t * *event*)

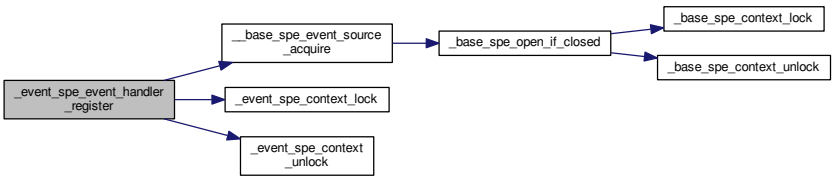
Definition at line 155 of file spe_event.c.

References __base_spe_event_source_acquire(), __SPE_EPOLL_FD_GET, __SPE_EVENT_ALL, __SPE_EVENT_CONTEXT_PRIV_GET, __SPE_EVENT_IN_MBOX, __SPE_EVENT_OUT_INTR_MBOX, __SPE_EVENT_SPE_STOPPED, __SPE_EVENT_TAG_GROUP, __SPE_EVENTS_ENABLED, _event_spe_context_lock(), _event_spe_context_unlock(), spe_context::base_private, spe_event_unit::data, spe_context_event_priv::events, spe_event_unit::events, FD_IBOX, FD_MFC, FD_WBOX, spe_context_base_priv::flags, spe_event_data::ptr, spe_event_unit::spe, SPE_EVENT_IN_MBOX, SPE_EVENT_OUT_INTR_MBOX, SPE_EVENT_SPE_STOPPED, SPE_EVENT_TAG_GROUP, SPE_MAP_PS, and spe_context_event_priv::stop_event_pipe.

```
156 {
157   int epfd;
158   const int ep_op = EPOLL_CTL_ADD;
159   spe_context_event_priv_ptr_t evctx;
160   spe_event_unit_t *ev_buf;
161   struct epoll_event ep_event;
162   int fd;
163
164   if (!evhandler) {
165     errno = ESRCH;
166     return -1;
167   }
168   if (!event || !event->spe) {
169     errno = EINVAL;
170     return -1;
171   }
172   if (!__SPE_EVENTS_ENABLED(event->spe)) {
173     errno = ENOTSUP;
174     return -1;
175   }
176
177   epfd = __SPE_EPOLL_FD_GET(evhandler);
178   evctx = __SPE_EVENT_CONTEXT_PRIV_GET(event->spe);
179
180   if (event->events & ~__SPE_EVENT_ALL) {
181     errno = ENOTSUP;
182     return -1;
183   }
184
185   _event_spe_context_lock(event->spe); /* for spe->event_private->events */
186
187   if (event->events & SPE_EVENT_OUT_INTR_MBOX) {
188     fd = __base_spe_event_source_acquire(event->
    spe, FD_IBOX);
189     if (fd == -1) {
190       _event_spe_context_unlock(event->spe);
191       return -1;
192     }
193
194     ev_buf = &evctx->events[__SPE_EVENT_OUT_INTR_MBOX];
195     ev_buf->events = SPE_EVENT_OUT_INTR_MBOX;
196     ev_buf->data = event->data;
197
198     ep_event.events = EPOLLIN;
199     ep_event.data.ptr = ev_buf;
200     if (epoll_ctl(epfd, ep_op, fd, &ep_event) == -1) {
201       _event_spe_context_unlock(event->spe);
202       return -1;
203     }
204   }
205
206   if (event->events & SPE_EVENT_IN_MBOX) {
207     fd = __base_spe_event_source_acquire(event->
    spe, FD_WBOX);
208     if (fd == -1) {
209       _event_spe_context_unlock(event->spe);
210       return -1;
211     }
212
213     ev_buf = &evctx->events[__SPE_EVENT_IN_MBOX];
214     ev_buf->events = SPE_EVENT_IN_MBOX;
215     ev_buf->data = event->data;
216
217     ep_event.events = EPOLLOUT;
```

```
218     ep_event.data.ptr = ev_buf;
219     if (epoll_ctl(epfd, ep_op, fd, &ep_event) == -1) {
220       _event_spe_context_unlock(event->spe);
221       return -1;
222     }
223   }
224
225   if (event->events & SPE_EVENT_TAG_GROUP) {
226     fd = __base_spe_event_source_acquire(event->
      spe, FD_MFC);
227     if (fd == -1) {
228       _event_spe_context_unlock(event->spe);
229       return -1;
230     }
231
232     if (event->spe->base_private->flags & SPE_MAP_PS) {
233             _event_spe_context_unlock(event->spe);
234             errno = ENOTSUP;
235             return -1;
236     }
237
238     ev_buf = &evctx->events[__SPE_EVENT_TAG_GROUP];
239     ev_buf->events = SPE_EVENT_TAG_GROUP;
240     ev_buf->data = event->data;
241
242     ep_event.events = EPOLLIN;
243     ep_event.data.ptr = ev_buf;
244     if (epoll_ctl(epfd, ep_op, fd, &ep_event) == -1) {
245       _event_spe_context_unlock(event->spe);
246       return -1;
247     }
248   }
249
250   if (event->events & SPE_EVENT_SPE_STOPPED) {
251     fd = evctx->stop_event_pipe[0];
252
253     ev_buf = &evctx->events[__SPE_EVENT_SPE_STOPPED];
254     ev_buf->events = SPE_EVENT_SPE_STOPPED;
255     ev_buf->data = event->data;
256
257     ep_event.events = EPOLLIN;
258     ep_event.data.ptr = ev_buf;
259     if (epoll_ctl(epfd, ep_op, fd, &ep_event) == -1) {
260       _event_spe_context_unlock(event->spe);
261       return -1;
262     }
263   }
264
265   _event_spe_context_unlock(event->spe);
266
267   return 0;
268 }
```

Here is the call graph for this function:



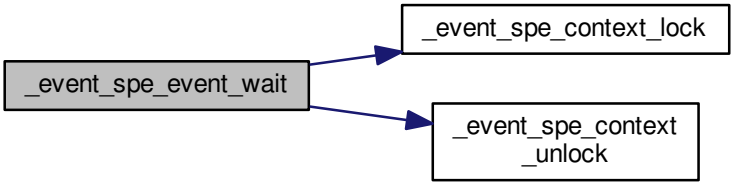
int _event_spe_event_wait (spe_event_handler_ptr_t *evhandler*, spe_event_unit_t * *events*, int *max_events*, int *timeout*)

Definition at line 360 of file spe_event.c.

References __SPE_EPOLL_FD_GET, _event_spe_context_lock(), _event_spe_context_unlock(), and spe_event_unit::spe.

```
361 {
362   int epfd;
363   struct epoll_event *ep_events;
364   int rc;
365 
366   if (!evhandler) {
367     errno = ESRCH;
368     return -1;
369   }
370   if (!events || max_events <= 0) {
371     errno = EINVAL;
372     return -1;
373   }
374 
375   epfd = __SPE_EPOLL_FD_GET(evhandler);
376 
377   ep_events = malloc(sizeof(*ep_events) * max_events);
378   if (!ep_events) {
379     return -1;
380   }
381 
382   for ( ; ; ) {
383     rc = epoll_wait(epfd, ep_events, max_events, timeout);
384     if (rc == -1) { /* error */
385       if (errno == EINTR) {
386         if (timeout >= 0) { /* behave as timeout */
387           rc = 0;
388           break;
389         }
390         /* else retry */
391       }
392       else {
393         break;
394       }
395     }
396     else if (rc > 0) {
397       int i;
398       for (i = 0; i < rc; i++) {
399         spe_event_unit_t *ev = (spe_event_unit_t *)(ep_events[i].data.ptr);
400         _event_spe_context_lock(ev->spe); /* lock ev itself */
401         events[i] = *ev;
402         _event_spe_context_unlock(ev->spe);
403       }
404       break;
405     }
406     else { /* timeout */
407       break;
408     }
409   }
410 
411   free(ep_events);
412 
413   return rc;
414 }
```

Here is the call graph for this function:



int _event_spe_stop_info_read (spe_context_ptr_t *spe*, spe_stop_info_t * *stopinfo*)

Definition at line 59 of file spe_event.c.

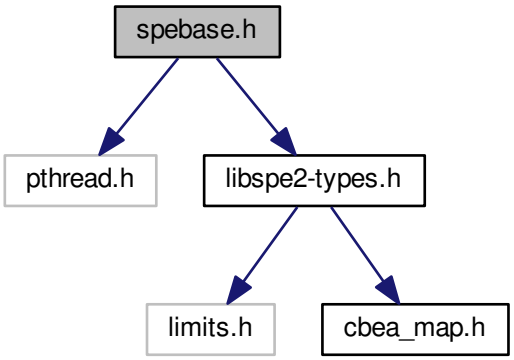
References __SPE_EVENT_CONTEXT_PRIV_GET, spe_context_event_priv::stop_event_pipe, and spe_context_event_priv::stop_event_read_lock.

```
60 {
61   spe_context_event_priv_ptr_t evctx;
62   int rc;
63   int fd;
64   size_t total;
65
66   evctx = __SPE_EVENT_CONTEXT_PRIV_GET(spe);
67   fd = evctx->stop_event_pipe[0];
68
69   pthread_mutex_lock(&evctx->stop_event_read_lock); /* for atomic read */
70
71   rc = read(fd, stopinfo, sizeof(*stopinfo));
72   if (rc == -1) {
73     pthread_mutex_unlock(&evctx->stop_event_read_lock);
74     return -1;
75   }
76
77   total = rc;
78   while (total < sizeof(*stopinfo)) { /* this loop will be executed in few cases */
79     struct pollfd fds;
80     fds.fd = fd;
81     fds.events = POLLIN;
82     rc = poll(&fds, 1, -1);
83     if (rc == -1) {
84       if (errno != EINTR) {
85         break;
86       }
87     }
88     else if (rc == 1) {
89       rc = read(fd, (char *)stopinfo + total, sizeof(*stopinfo) - total);
90       if (rc == -1) {
91         if (errno != EAGAIN) {
92           break;
93         }
94       }
95       else {
96         total += rc;
97       }
98     }
99   }
100
101   pthread_mutex_unlock(&evctx->stop_event_read_lock);
102
103   return rc == -1 ? -1 : 0;
104 }
```

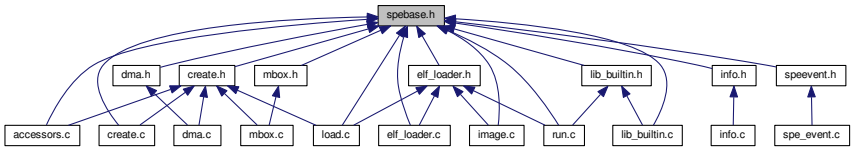
3.23 spebase.h File Reference

```
#include <pthread.h>
#include "libspe2-types.h"
```

Include dependency graph for spebase.h:



This graph shows which files directly or indirectly include this file:



Data Structures

- struct spe_context_base_priv
- struct spe_gang_context_base_priv

Macros

- #define __PRINTF(fmt, args...) { fprintf(stderr,fmt , ## args); }
- #define DEBUG_PRINTF(fmt, args...)
- #define LS_SIZE 0x40000 /* 256K (in bytes) */
- #define PSMAP_SIZE 0x20000 /* 128K (in bytes) */
- #define MFC_SIZE 0x1000
- #define MSS_SIZE 0x1000
- #define CNTL_SIZE 0x1000
- #define SIGNAL_SIZE 0x1000
- #define MSSYNC_OFFSET 0x00000
- #define MFC_OFFSET 0x03000
- #define CNTL_OFFSET 0x04000
- #define SIGNAL1_OFFSET 0x14000
- #define SIGNAL2_OFFSET 0x1c000

- #define SPE_EMULATE_PARAM_BUFFER 0x3e000
- #define SPE_PROGRAM_NORMAL_END 0x2000
- #define SPE_PROGRAM_LIBRARY_CALL 0x2100
- #define SPE_PROGRAM_ISOLATED_STOP 0x2200
- #define SPE_PROGRAM_ISO_LOAD_COMPLETE 0x2206

Enumerations

- enum fd_name {
  FD_MBOX, FD_MBOX_STAT, FD_IBOX, FD_IBOX_NB,
  FD_IBOX_STAT, FD_WBOX, FD_WBOX_NB, FD_WBOX_STAT,
  FD_SIG1, FD_SIG2, FD_MFC, FD_MSS,
  NUM_MBOX_FDS }

Functions

- spe_context_ptr_t _base_spe_context_create (unsigned int flags, spe_gang_context_ptr_t gctx, spe_context_ptr_t aff_spe)
- spe_gang_context_ptr_t _base_spe_gang_context_create (unsigned int flags)
- int _base_spe_program_load (spe_context_ptr_t spectx, spe_program_handle_t *program)
- void _base_spe_program_load_complete (spe_context_ptr_t spectx)
- int _base_spe_emulated_loader_present (void)
- int _base_spe_context_destroy (spe_context_ptr_t spectx)
- int _base_spe_gang_context_destroy (spe_gang_context_ptr_t gctx)
- int _base_spe_context_run (spe_context_ptr_t spe, unsigned int *entry, unsigned int runflags, void *argp, void *envp, spe_stop_info_t *stopinfo)
- int _base_spe_image_close (spe_program_handle_t *handle)
- spe_program_handle_t * _base_spe_image_open (const char *filename)
- int _base_spe_mfcio_put (spe_context_ptr_t spectx, unsigned int ls, void *ea, unsigned int size, unsigned int tag, unsigned int tid, unsigned int rid)
- int _base_spe_mfcio_putb (spe_context_ptr_t spectx, unsigned int ls, void *ea, unsigned int size, unsigned int tag, unsigned int tid, unsigned int rid)
- int _base_spe_mfcio_putf (spe_context_ptr_t spectx, unsigned int ls, void *ea, unsigned int size, unsigned int tag, unsigned int tid, unsigned int rid)
- int _base_spe_mfcio_get (spe_context_ptr_t spectx, unsigned int ls, void *ea, unsigned int size, unsigned int tag, unsigned int tid, unsigned int rid)
- int _base_spe_mfcio_getb (spe_context_ptr_t spectx, unsigned int ls, void *ea, unsigned int size, unsigned int tag, unsigned int tid, unsigned int rid)
- int _base_spe_mfcio_getf (spe_context_ptr_t spectx, unsigned int ls, void *ea, unsigned int size, unsigned int tag, unsigned int tid, unsigned int rid)
- int _base_spe_out_mbox_read (spe_context_ptr_t spectx, unsigned int mbox_data[ ], int count)
- int _base_spe_in_mbox_write (spe_context_ptr_t spectx, unsigned int mbox_data[ ], int count, int behavior_flag)
- int _base_spe_in_mbox_status (spe_context_ptr_t spectx)
- int _base_spe_out_mbox_status (spe_context_ptr_t spectx)
- int _base_spe_out_intr_mbox_status (spe_context_ptr_t spectx)
- int _base_spe_out_intr_mbox_read (spe_context_ptr_t spectx, unsigned int mbox_data[ ], int count, int behavior_flag)
- int _base_spe_signal_write (spe_context_ptr_t spectx, unsigned int signal_reg, unsigned int data)
- int _base_spe_callback_handler_register (void *handler, unsigned int callnum, unsigned int mode)
- int _base_spe_callback_handler_deregister (unsigned int callnum)
- void * _base_spe_callback_handler_query (unsigned int callnum)

- int _base_spe_stop_reason_get (spe_context_ptr_t spectx)
- int _base_spe_mfcio_tag_status_read (spe_context_ptr_t spectx, unsigned int mask, unsigned int behavior, unsigned int *tag_status)
- int __base_spe_stop_event_source_get (spe_context_ptr_t spectx)
- int __base_spe_stop_event_target_get (spe_context_ptr_t spectx)
- int _base_spe_stop_status_get (spe_context_ptr_t spectx)
- int __base_spe_event_source_acquire (struct spe_context *spectx, enum fd_name fdesc)
- void __base_spe_event_source_release (struct spe_context *spectx, enum fd_name fdesc)
- void * _base_spe_ps_area_get (struct spe_context *spectx, enum ps_area area)
- int __base_spe_spe_dir_get (struct spe_context *spectx)
- void * _base_spe_ls_area_get (struct spe_context *spectx)
- int _base_spe_ls_size_get (spe_context_ptr_t spe)
- void _base_spe_context_lock (spe_context_ptr_t spe, enum fd_name fd)
- void _base_spe_context_unlock (spe_context_ptr_t spe, enum fd_name fd)
- int _base_spe_cpu_info_get (int info_requested, int cpu_node)
- void __spe_context_update_event (void)
- int _base_spe_mssync_start (spe_context_ptr_t spectx)
- int _base_spe_mssync_status (spe_context_ptr_t spectx)

3.23.1 Detailed Description

spebase.h contains the public API funtions
Definition in file spebase.h.

3.23.2 Macro Definition Documentation

#define __PRINTF(*fmt, args...*) { fprintf(stderr,fmt , ## args); }

Definition at line 34 of file spebase.h.

#define CNTL_OFFSET 0x04000

Definition at line 124 of file spebase.h.
Referenced by _base_spe_context_create().

#define CNTL_SIZE 0x1000

Definition at line 119 of file spebase.h.
Referenced by _base_spe_context_create().

#define DEBUG_PRINTF(*fmt, args...*)

Definition at line 38 of file spebase.h.

#define LS_SIZE 0x40000 /* 256K (in bytes) */

Definition at line 115 of file spebase.h.

#define MFC_OFFSET 0x03000

Definition at line 123 of file spebase.h.
Referenced by _base_spe_context_create().

#define MFC_SIZE 0x1000

Definition at line 117 of file spebase.h.
Referenced by _base_spe_context_create().

#define MSS_SIZE 0x1000

Definition at line 118 of file spebase.h.
Referenced by _base_spe_context_create().

#define MSSYNC_OFFSET 0x00000

Definition at line 122 of file spebase.h.
Referenced by _base_spe_context_create().

#define PSMAP_SIZE 0x20000 /∗ 128K (in bytes) ∗/

Definition at line 116 of file spebase.h.
Referenced by _base_spe_context_create().

#define SIGNAL1_OFFSET 0x14000

Definition at line 125 of file spebase.h.
Referenced by _base_spe_context_create().

#define SIGNAL2_OFFSET 0x1c000

Definition at line 126 of file spebase.h.
Referenced by _base_spe_context_create().

#define SIGNAL_SIZE 0x1000

Definition at line 120 of file spebase.h.
Referenced by _base_spe_context_create().

#define SPE_EMULATE_PARAM_BUFFER 0x3e000

Location of the PPE-assisted library call buffer for emulated isolation contexts.
Definition at line 132 of file spebase.h.
Referenced by _base_spe_handle_library_callback().

#define SPE_PROGRAM_ISO_LOAD_COMPLETE 0x2206

Definition at line 143 of file spebase.h.
Referenced by _base_spe_context_run().

#define SPE_PROGRAM_ISOLATED_STOP 0x2200

Isolated exit codes: 0x220x
Definition at line 142 of file spebase.h.
Referenced by _base_spe_context_run().

#define SPE_PROGRAM_LIBRARY_CALL 0x2100

Definition at line 137 of file spebase.h.
Referenced by _base_spe_context_run().

#define SPE_PROGRAM_NORMAL_END 0x2000

Definition at line 136 of file spebase.h.
Referenced by _base_spe_context_run().

3.23.3 Enumeration Type Documentation

enum fd_name

NOTE: NUM_MBOX_FDS must always be the last element in the enumeration

Enumerator

FD_MBOX

FD_MBOX_STAT

FD_IBOX

FD_IBOX_NB

FD_IBOX_STAT

FD_WBOX

FD_WBOX_NB

FD_WBOX_STAT

FD_SIG1

FD_SIG2

FD_MFC

FD_MSS

NUM_MBOX_FDS

Definition at line 42 of file spebase.h.

```
42              {
43          FD_MBOX,
44          FD_MBOX_STAT,
45          FD_IBOX,
46          FD_IBOX_NB,
47          FD_IBOX_STAT,
48          FD_WBOX,
49          FD_WBOX_NB,
50          FD_WBOX_STAT,
51          FD_SIG1,
52          FD_SIG2,
53          FD_MFC,
54          FD_MSS,
55          NUM_MBOX_FDS
56 };
```

3.23.4 Function Documentation

int __base_spe_event_source_acquire (struct spe_context * *spectx*, enum fd_name *fdesc*)

__base_spe_event_source_acquire opens a file descriptor to the specified event source
Parameters

spectx	Specifies the SPE context

fdesc	Specifies the event source

void __base_spe_event_source_release (struct spe_context * *spectx*, enum fd_name *fdesc*)

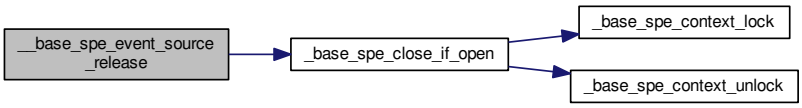
__base_spe_event_source_release releases the file descriptor to the specified event source
Parameters

spectx	Specifies the SPE context
fdesc	Specifies the event source

Definition at line 79 of file accessors.c.
References _base_spe_close_if_open().

```
80 {
81         _base_spe_close_if_open(spe, fdesc);
82 }
```

Here is the call graph for this function:



int __base_spe_spe_dir_get (struct spe_context * *spectx*)

__base_spe_spe_dir_get return the file descriptor of the SPE directory in spufs
Parameters

spectx	Specifies the SPE context

int __base_spe_stop_event_source_get (spe_context_ptr_t *spe*)

__base_spe_stop_event_source_get
Parameters

spectx	Specifies the SPE context

speevent users read from this end
Definition at line 92 of file accessors.c.
References spe_context::base_private, and spe_context_base_priv::ev_pipe.

```
93 {
94         return spe->base_private->ev_pipe[1];
95 }
```

int __base_spe_stop_event_target_get (spe_context_ptr_t *spe*)

__base_spe_stop_event_target_get

Parameters

spectx	Specifies the SPE context

speevent writes to this end

Definition at line 100 of file accessors.c.

References spe_context::base_private, and spe_context_base_priv::ev_pipe.

```
101 {
102         return spe->base_private->ev_pipe[0];
103 }
```

void __spe_context_update_event (void)

__spe_context_update_event internal function for gdb notification.

Referenced by _base_spe_context_destroy(), and _base_spe_program_load_complete().

int _base_spe_callback_handler_deregister (unsigned int *callnum*)

unregister a handler function for the specified number NOTE: unregistering a handler from call zero and one is ignored.

Definition at line 78 of file lib_builtin.c.

References MAX_CALLNUM, and RESERVED.

```
79 {
80         errno = 0;
81         if (callnum > MAX_CALLNUM) {
82                 errno = EINVAL;
83                 return -1;
84         }
85         if (callnum < RESERVED) {
86                 errno = EACCES;
87                 return -1;
88         }
89         if (handlers[callnum] == NULL) {
90                 errno = ESRCH;
91                 return -1;
92         }
93
94         handlers[callnum] = NULL;
95         return 0;
96 }
```

void* _base_spe_callback_handler_query (unsigned int *callnum*)

query a handler function for the specified number

Definition at line 98 of file lib_builtin.c.

References MAX_CALLNUM.

```
99 {
100         errno = 0;
101
102         if (callnum > MAX_CALLNUM) {
103                 errno = EINVAL;
104                 return NULL;
105         }
106         if (handlers[callnum] == NULL) {
107                 errno = ESRCH;
108                 return NULL;
109         }
110         return handlers[callnum];
111 }
```

int _base_spe_callback_handler_register (void * *handler*, unsigned int *callnum*, unsigned int *mode*)

register a handler function for the specified number NOTE: registering a handler to call zero and one is ignored.

Definition at line 40 of file lib_builtin.c.

References MAX_CALLNUM, RESERVED, SPE_CALLBACK_NEW, and SPE_CALLBACK_UPDATE.

```
41 {
42         errno = 0;
43
44         if (callnum > MAX_CALLNUM) {
45                 errno = EINVAL;
46                 return -1;
47         }
48
49         switch(mode){
50         case SPE_CALLBACK_NEW:
51                 if (callnum < RESERVED) {
52                         errno = EACCES;
53                         return -1;
54                 }
55                 if (handlers[callnum] != NULL) {
56                         errno = EACCES;
57                         return -1;
58                 }
59                 handlers[callnum] = handler;
60                 break;
61
62         case SPE_CALLBACK_UPDATE:
63                 if (handlers[callnum] == NULL) {
64                         errno = ESRCH;
65                         return -1;
66                 }
67                 handlers[callnum] = handler;
68                 break;
69         default:
70                 errno = EINVAL;
71                 return -1;
72                 break;
73         }
74         return 0;
75
76 }
```

spe_context_ptr_t _base_spe_context_create (unsigned int *flags*, spe_gang_context_ptr_t *gctx*, spe_context_ptr_t *aff_spe*)

_base_spe_context_create creates a single SPE context, i.e., the corresponding directory is created in SPUFS either as a subdirectory of a gang or individually (maybe this is best considered a gang of one)

Parameters

flags	
gctx	specify NULL if not belonging to a gang
aff_spe	specify NULL to skip affinity information

Definition at line 183 of file create.c.

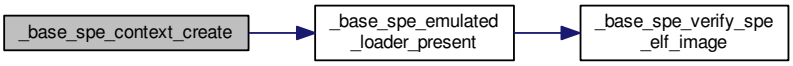
References _base_spe_emulated_loader_present(), spe_context::base_private, spe_gang_context::base_private, spe_context_base_priv::cntl_mmap_base, CNTL_OFFSET, CNTL_SIZE, DEBUG_PRINTF, spe_context_base_priv::fd_lock, spe_context_base_priv::fd_spe_dir, spe_context_base_priv::flags, spe_gang_context_base_priv::gangname, spe_context_base_priv::loaded_program, LS_SIZE, spe_context_base_priv::mem_mmap_base, spe_context_base_priv::mfc_mmap_base, MFC_OFFSET, MFC_SIZE, MSS_SIZE, spe_context_base_priv::mssync_mmap_base, MSSYNC_OFFSET, NUM_MBOX_FDS, spe_context_base_priv::psmap_mmap_base, PSMAP_SIZE, spe_context_base_priv::signal1_mmap_base, SIGNAL1_OFFSET, spe_context_base_priv::signal2_mmap_base, SIGNAL2_OFFSET, SIGNAL_SIZE, SPE_AFFINITY_MEMORY, SPE_CFG_SIGNOTIFY1_OR, SPE_CFG_SIGNOTIFY2_OR, SPE_EVENTS_ENABLE, spe_context_base_priv::spe_fds_array, SPE_ISOLATE, SPE_ISOLATE_EMULATE, and SPE_MAP_PS.

```
185 {
186         char pathname[256];
187         int i, aff_spe_fd = 0;
188         unsigned int spu_createflags = 0;
189         struct spe_context *spe = NULL;
190         struct spe_context_base_priv *priv;
191 
192         /* We need a loader present to run in emulated isolated mode */
193         if (flags & SPE_ISOLATE_EMULATE
194                         && !base_spe_emulated_loader_present()) {
195                 errno = EINVAL;
196                 return NULL;
197         }
198 
199         /* Put some sane defaults into the SPE context */
200         spe = malloc(sizeof(*spe));
201         if (!spe) {
202                 DEBUG_PRINTF("ERROR: Could not allocate spe context.\n");
203                 return NULL;
204         }
205         memset(spe, 0, sizeof(*spe));
206 
207         spe->base_private = malloc(sizeof(*spe->base_private));
208         if (!spe->base_private) {
209                 DEBUG_PRINTF("ERROR: Could not allocate "
210                                 "spe->base_private context.\n");
211                 free(spe);
212                 return NULL;
213         }
214 
215         /* just a convenience variable */
216         priv = spe->base_private;
217 
218         priv->fd_spe_dir = -1;
219         priv->mem_mmap_base = MAP_FAILED;
220         priv->psmap_mmap_base = MAP_FAILED;
221         priv->mssync_mmap_base = MAP_FAILED;
222         priv->mfc_mmap_base = MAP_FAILED;
223         priv->cntl_mmap_base = MAP_FAILED;
224         priv->signal1_mmap_base = MAP_FAILED;
225         priv->signal2_mmap_base = MAP_FAILED;
226         priv->loaded_program = NULL;
227 
228         for (i = 0; i < NUM_MBOX_FDS; i++) {
229                 priv->spe_fds_array[i] = -1;
230                 pthread_mutex_init(&priv->fd_lock[i], NULL);
231         }
232 
233         /* initialise spu_createflags */
234         if (flags & SPE_ISOLATE) {
235                 flags |= SPE_MAP_PS;
236                 spu_createflags |= SPU_CREATE_ISOLATE | SPU_CREATE_NOSCHED;
237         }
238 
239         if (flags & SPE_EVENTS_ENABLE)
240                 spu_createflags |= SPU_CREATE_EVENTS_ENABLED;
241 
242         if (aff_spe)
243                 spu_createflags |= SPU_CREATE_AFFINITY_SPU;
244 
245         if (flags & SPE_AFFINITY_MEMORY)
246                 spu_createflags |= SPU_CREATE_AFFINITY_MEM;
247 
248         /* Make the SPUFS directory for the SPE */
249         if (gctx == NULL)
250                 sprintf(pathname, "/spu/spethread-%i-%lu",
251                         getpid(), (unsigned long)spe);
252         else
253                 sprintf(pathname, "/spu/%s/spethread-%i-%lu",
254                         gctx->base_private->gangname, getpid(),
255                         (unsigned long)spe);
256 
257         if (aff_spe)
258                 aff_spe_fd = aff_spe->base_private->fd_spe_dir;
259 
260         priv->fd_spe_dir = spu_create(pathname, spu_createflags,
261                         S_IRUSR | S_IWUSR | S_IXUSR, aff_spe_fd);
262 
263         if (priv->fd_spe_dir < 0) {
264                 int errno_saved = errno; /* save errno to prevent being overwritten */
```

```
265                 DEBUG_PRINTF("ERROR: Could not create SPE %s\n", pathname);
266                 perror("spu_create()");
267                 free_spe_context(spe);
268                 /* we mask most errors, but leave ENODEV, etc */
269                 switch (errno_saved) {
270                 case ENOTSUP:
271                 case EEXIST:
272                 case EINVAL:
273                 case EBUSY:
274                 case EPERM:
275                 case ENODEV:
276                         errno = errno_saved; /* restore errno */
277                         break;
278                 default:
279                         errno = EFAULT;
280                         break;
281                 }
282                 return NULL;
283         }
284 
285         priv->flags = flags;
286 
287         /* Map the required areas into process memory */
288         priv->mem_mmap_base = mapfileat(priv->fd_spe_dir, "mem",
    LS_SIZE);
289         if (priv->mem_mmap_base == MAP_FAILED) {
290                 DEBUG_PRINTF("ERROR: Could not map SPE memory.\n");
291                 free_spe_context(spe);
292                 errno = ENOMEM;
293                 return NULL;
294         }
295 
296         if (flags & SPE_MAP_PS) {
297                 /* It's possible to map the entire problem state area with
298                  * one mmap - try this first */
299                 priv->psmap_mmap_base =  mapfileat(priv->
    fd_spe_dir,
300                                 "psmap", PSMAP_SIZE);
301 
302                 if (priv->psmap_mmap_base != MAP_FAILED) {
303                         priv->mssync_mmap_base =
304                                 priv->psmap_mmap_base +
    MSSYNC_OFFSET;
305                         priv->mfc_mmap_base =
306                                 priv->psmap_mmap_base +
    MFC_OFFSET;
307                         priv->cntl_mmap_base =
308                                 priv->psmap_mmap_base +
    CNTL_OFFSET;
309                         priv->signal1_mmap_base =
310                                 priv->psmap_mmap_base +
    SIGNAL1_OFFSET;
311                         priv->signal2_mmap_base =
312                                 priv->psmap_mmap_base +
    SIGNAL2_OFFSET;
313 
314                 } else {
315                         /* map each region separately */
316                         priv->mfc_mmap_base =
317                                 mapfileat(priv->fd_spe_dir, "mfc",
    MFC_SIZE);
318                         priv->mssync_mmap_base =
319                                 mapfileat(priv->fd_spe_dir, "mss",
    MSS_SIZE);
320                         priv->cntl_mmap_base =
321                                 mapfileat(priv->fd_spe_dir, "cntl",
    CNTL_SIZE);
322                         priv->signal1_mmap_base =
323                                 mapfileat(priv->fd_spe_dir, "signal1",
324                                                 SIGNAL_SIZE);
325                         priv->signal2_mmap_base =
326                                 mapfileat(priv->fd_spe_dir, "signal2",
327                                                 SIGNAL_SIZE);
328 
329                         if (priv->mfc_mmap_base == MAP_FAILED ||
330                                         priv->cntl_mmap_base == MAP_FAILED ||
331                                         priv->signal1_mmap_base == MAP_FAILED ||
332                                         priv->signal2_mmap_base == MAP_FAILED) {
333                                 DEBUG_PRINTF("ERROR: Could not map SPE "
334                                                 "PS memory.\n");
```

```
335                                 free_spe_context(spe);
336                                 errno = ENOMEM;
337                                 return NULL;
338                         }
339                 }
340         }
341
342         if (flags & SPE_CFG_SIGNOTIFY1_OR) {
343                 if (setsignotify(priv->fd_spe_dir, "signal1_type")) {
344                         DEBUG_PRINTF("ERROR: Could not open SPE "
345                                      "signal1_type file.\n");
346                         free_spe_context(spe);
347                         errno = EFAULT;
348                         return NULL;
349                 }
350         }
351
352         if (flags & SPE_CFG_SIGNOTIFY2_OR) {
353                 if (setsignotify(priv->fd_spe_dir, "signal2_type")) {
354                         DEBUG_PRINTF("ERROR: Could not open SPE "
355                                      "signal2_type file.\n");
356                         free_spe_context(spe);
357                         errno = EFAULT;
358                         return NULL;
359                 }
360         }
361
362         return spe;
363 }
```

Here is the call graph for this function:



int _base_spe_context_destroy (spe_context_ptr_t *spectx*)

_base_spe_context_destroy cleans up what is left when an SPE executable has exited. Closes open file handles and unmaps memory areas.

Parameters

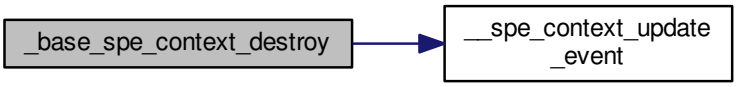
spectx	Specifies the SPE context

Definition at line 418 of file create.c.

References __spe_context_update_event().

```
419 {
420         int ret = free_spe_context(spe);
421
422         __spe_context_update_event();
423
424         return ret;
425 }
```

Here is the call graph for this function:



void _base_spe_context_lock (spe_context_ptr_t *spe,* enum fd_name *fd*)

_base_spe_context_lock locks members of the SPE context
Parameters

spectx	Specifies the SPE context
fd	Specifies the file

Definition at line 91 of file create.c.
References spe_context::base_private, and spe_context_base_priv::fd_lock.
Referenced by _base_spe_close_if_open(), and _base_spe_open_if_closed().

```
92 {
93         pthread_mutex_lock(&spe->base_private->fd_lock[fdesc]);
94 }
```

int _base_spe_context_run (spe_context_ptr_t *spe,* unsigned int * *entry,* unsigned int *runflags,* void * *argp,* void * *envp,* spe_stop_info_t * *stopinfo*)

_base_spe_context_run starts execution of an SPE context with a loaded image
Parameters

spectx	Specifies the SPE context
entry	entry point for the SPE programm. If set to 0, entry point is determined by the ELF loader.
runflags	valid values are: SPE_RUN_USER_REGS Specifies that the SPE setup registers r3, r4, and r5 are initialized with the 48 bytes pointed to by argp. SPE_NO_CALLBACKS do not use built in library functions.
argp	An (optional) pointer to application specific data, and is passed as the second parameter to the SPE program.
envp	An (optional) pointer to environment specific data, and is passed as the third parameter to the SPE program.

Definition at line 99 of file run.c.
References __spe_current_active_context, _base_spe_handle_library_callback(), _base_spe_program_load_complete(), spe_context::base_private, DEBUG_PRINTF, spe_context_base_priv::emulated_entry, spe_context_base_priv::entry, spe_context_base_priv::fd_spe_dir, spe_context_base_priv::flags, LS_SIZE, spe_context_base_priv::mem_mmap_base, spe_context_info::npc, spe_context_info::prev, spe_stop_info::result, spe_stop_info::spe_callback_error, SPE_CALLBACK_ERROR, SPE_DEFAULT_ENTRY, SPE_EVENTS_ENABLE, SPE_EXIT, spe_stop_info::spe_exit_code, spe_context_info::spe_id, SPE_ISOLATE, SPE_ISOLATE_EMULATE, spe_stop_info::spe_isolation_error, SPE_ISOLATION_ERROR, SPE_NO_CALLBACKS, S-

PE_PROGRAM_ISO_LOAD_COMPLETE, SPE_PROGRAM_ISOLATED_STOP, SPE_PROGRAM_LIBRARY_CALL, SPE_PROGRAM_NORMAL_END, SPE_RUN_USER_REGS, spe_stop_info::spe_runtime_error, SPE_RUNTIME_ERROR, spe_stop_info::spe_runtime_exception, SPE_RUNTIME_EXCEPTION, spe_stop_info::spe_runtime_fatal, SPE_RUNTIME_FATAL, spe_stop_info::spe_signal_code, SPE_SPU_HALT, SPE_SPU_INVALID_CHANNEL, SPE_SPU_INVALID_INSTR, SPE_SPU_STOPPED_BY_STOP, SPE_SPU_WAITING_ON_CHANNEL, SPE_STOP_AND_SIGNAL, spe_stop_info::spu_status, spe_context_info::status, spe_stop_info::stop_reason, addr64::ui, and addr64::ull.

Referenced by _event_spe_context_run().

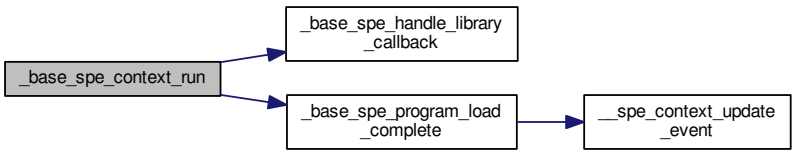
```
102 {
103         int retval = 0, run_rc;
104         unsigned int run_status, tmp_entry;
105         spe_stop_info_t  stopinfo_buf;
106         struct spe_context_info this_context_info __attribute__((cleanup(
    cleanupspeinfo)));
107
108         /* If the caller hasn't set a stopinfo buffer, provide a buffer on the
109          * stack instead. */
110         if (!stopinfo)
111                 stopinfo = &stopinfo_buf;
112
113
114         /* In emulated isolated mode, the npc will always return as zero.
115          * use our private entry point instead */
116         if (spe->base_private->flags & SPE_ISOLATE_EMULATE)
117                 tmp_entry = spe->base_private->emulated_entry;
118
119         else if (*entry == SPE_DEFAULT_ENTRY)
120                 tmp_entry = spe->base_private->entry;
121         else
122                 tmp_entry = *entry;
123
124         /* If we're starting the SPE binary from its original entry point,
125          * setup the arguments to main() */
126         if (tmp_entry == spe->base_private->entry &&
127                         !(spe->base_private->flags &
128                                 (SPE_ISOLATE | SPE_ISOLATE_EMULATE))) {
129
130                 addr64 argp64, envp64, tid64, ls64;
131                 unsigned int regs[128][4];
132
133                 /* setup parameters */
134                 argp64.ull = (uint64_t)(unsigned long)argp;
135                 envp64.ull = (uint64_t)(unsigned long)envp;
136                 tid64.ull = (uint64_t)(unsigned long)spe;
137
138                 /* make sure the register values are 0 */
139                 memset(regs, 0, sizeof(regs));
140
141                 /* set sensible values for stack_ptr and stack_size */
142                 regs[1][0] = (unsigned int) LS_SIZE - 16;        /* stack_ptr */
143                 regs[2][0] = 0;                                                 /* stack_size ( 0 =
     default ) */
144
145                 if (runflags & SPE_RUN_USER_REGS) {
146                         /* When SPE_USER_REGS is set, argp points to an array
147                          * of 3x128b registers to be passed directly to the SPE
148                          * program.
149                          */
150                         memcpy(regs[3], argp, sizeof(unsigned int) * 12);
151                 } else {
152                         regs[3][0] = tid64.ui[0];
153                         regs[3][1] = tid64.ui[1];
154
155                         regs[4][0] = argp64.ui[0];
156                         regs[4][1] = argp64.ui[1];
157
158                         regs[5][0] = envp64.ui[0];
159                         regs[5][1] = envp64.ui[1];
160                 }
161
162                 /* Store the LS base address in R6 */
163                 ls64.ull = (uint64_t)(unsigned long)spe->base_private->
    mem_mmap_base;
164                 regs[6][0] = ls64.ui[0];
165                 regs[6][1] = ls64.ui[1];
166
```

```
167                 if (set_regs(spe, regs))
168                         return -1;
169         }
170
171         /*Leave a trail of breadcrumbs for the debugger to follow */
172         if (!__spe_current_active_context) {
173                 __spe_current_active_context = &this_context_info;
174                 if (!__spe_current_active_context)
175                         return -1;
176                 __spe_current_active_context->prev = NULL;
177         } else {
178                 struct spe_context_info *newinfo;
179                 newinfo = &this_context_info;
180                 if (!newinfo)
181                         return -1;
182                 newinfo->prev = __spe_current_active_context;
183                 __spe_current_active_context = newinfo;
184         }
185         /*remember the ls-addr*/
186         __spe_current_active_context->spe_id = spe->
    base_private->fd_spe_dir;
187
188 do_run:
189         /*Remember the npc value*/
190         __spe_current_active_context->npc = tmp_entry;
191
192         /* run SPE context */
193         run_rc = spu_run(spe->base_private->fd_spe_dir,
194                         &tmp_entry, &run_status);
195
196         /*Remember the npc value*/
197         __spe_current_active_context->npc = tmp_entry;
198         __spe_current_active_context->status = run_status;
199
200         DEBUG_PRINTF("spu_run returned run_rc=0x%08x, entry=0x%04x, "
201                         "ext_status=0x%04x.\n", run_rc, tmp_entry, run_status);
202
203         /* set up return values and stopinfo according to spu_run exit
204          * conditions. This is overwritten on error.
205          */
206         stopinfo->spu_status = run_rc;
207
208         if (spe->base_private->flags & SPE_ISOLATE_EMULATE) {
209                 /* save the entry point, and pretend that the npc is zero */
210                 spe->base_private->emulated_entry = tmp_entry;
211                 *entry = 0;
212         } else {
213                 *entry = tmp_entry;
214         }
215
216         /* Return with stopinfo set on syscall error paths */
217         if (run_rc == -1) {
218                 DEBUG_PRINTF("spu_run returned error %d, errno=%d\n",
219                                 run_rc, errno);
220                 stopinfo->stop_reason = SPE_RUNTIME_FATAL;
221                 stopinfo->result.spe_runtime_fatal = errno;
222                 retval = -1;
223
224                 /* For isolated contexts, pass EPERM up to the
225                  * caller.
226                  */
227                 if (!(spe->base_private->flags & SPE_ISOLATE
228                                 && errno == EPERM))
229                         errno = EFAULT;
230
231         } else if (run_rc & SPE_SPU_INVALID_INSTR) {
232                 DEBUG_PRINTF("SPU has tried to execute an invalid "
233                                 "instruction. %d\n", run_rc);
234                 stopinfo->stop_reason = SPE_RUNTIME_ERROR;
235                 stopinfo->result.spe_runtime_error =
    SPE_SPU_INVALID_INSTR;
236                 errno = EFAULT;
237                 retval = -1;
238
239         } else if ((spe->base_private->flags &
    SPE_EVENTS_ENABLE) && run_status) {
240                 /* Report asynchronous error if return val are set and
241                  * SPU events are enabled.
242                  */
243                 stopinfo->stop_reason = SPE_RUNTIME_EXCEPTION;
```

```
244                 stopinfo->result.spe_runtime_exception = run_status;
245                 stopinfo->spu_status = -1;
246                 errno = EIO;
247                 retval = -1;
248
249         } else if (run_rc & SPE_SPU_STOPPED_BY_STOP) {
250                 /* Stop & signals are broken down into three groups
251                  *  1. SPE library call
252                  *  2. SPE user defined stop & signal
253                  *  3. SPE program end.
254                  *
255                  * These groups are signified by the 14-bit stop code:
256                  */
257                 int stopcode = (run_rc >> 16) & 0x3fff;
258
259                 /* Check if this is a library callback, and callbacks are
260                  * allowed (ie, running without SPE_NO_CALLBACKS)
261                  */
262                 if ((stopcode & 0xff00) == SPE_PROGRAM_LIBRARY_CALL
263                                 && !(runflags & SPE_NO_CALLBACKS)) {
264
265                         int callback_rc, callback_number = stopcode & 0xff;
266
267                         /* execute library callback */
268                         DEBUG_PRINTF("SPE library call: %d\n", callback_number);
269                         callback_rc = _base_spe_handle_library_callback(
    spe,
270                                                                         callback_number, *entry);
271
272                         if (callback_rc) {
273                                 /* library callback failed; set errno and
274                                  * return immediately */
275                                 DEBUG_PRINTF("SPE library call failed: %d\n",
276                                                 callback_rc);
277                                 stopinfo->stop_reason =
    SPE_CALLBACK_ERROR;
278                                 stopinfo->result.spe_callback_error =
279                                         callback_rc;
280                                 errno = EFAULT;
281                                 retval = -1;
282                         } else {
283                                 /* successful library callback - restart the SPE
284                                  * program at the next instruction */
285                                 tmp_entry += 4;
286                                 goto do_run;
287                         }
288
289                 } else if ((stopcode & 0xff00) == SPE_PROGRAM_NORMAL_END) {
290                         /* The SPE program has exited by exit(X) */
291                         stopinfo->stop_reason = SPE_EXIT;
292                         stopinfo->result.spe_exit_code = stopcode & 0xff;
293
294                         if (spe->base_private->flags &
    SPE_ISOLATE) {
295                                 /* Issue an isolated exit, and re-run the SPE.
296                                  * We should see a return value without the
297                                  * 0x80 bit set. */
298                                 if (!issue_isolated_exit(spe))
299                                         goto do_run;
300                                 retval = -1;
301                         }
302
303                 } else if ((stopcode & 0xfff0) == SPE_PROGRAM_ISOLATED_STOP) {
304
305                         /* 0x2206: isolated app has been loaded by loader;
306                          * provide a hook for the debugger to catch this,
307                          * and restart
308                          */
309                         if (stopcode == SPE_PROGRAM_ISO_LOAD_COMPLETE) {
310                                 _base_spe_program_load_complete(spe);
311                                 goto do_run;
312                         } else {
313                                 stopinfo->stop_reason =
    SPE_ISOLATION_ERROR;
314                                 stopinfo->result.spe_isolation_error =
315                                         stopcode & 0xf;
316                         }
317
318                 } else if (spe->base_private->flags &
    SPE_ISOLATE &&
```

```
319                             !(run_rc & 0x80)) {
320                         /* We've successfully exited isolated mode */
321                         retval = 0;
322
323                 } else {
324                         /* User defined stop & signal, including
325                          * callbacks when disabled */
326                         stopinfo->stop_reason = SPE_STOP_AND_SIGNAL;
327                         stopinfo->result.spe_signal_code = stopcode;
328                         retval = stopcode;
329                 }
330
331         } else if (run_rc & SPE_SPU_HALT) {
332                 DEBUG_PRINTF("SPU was stopped by halt. %d\n", run_rc);
333                 stopinfo->stop_reason = SPE_RUNTIME_ERROR;
334                 stopinfo->result.spe_runtime_error =
    SPE_SPU_HALT;
335                 errno = EFAULT;
336                 retval = -1;
337
338         } else if (run_rc & SPE_SPU_WAITING_ON_CHANNEL) {
339                 DEBUG_PRINTF("SPU is waiting on channel. %d\n", run_rc);
340                 stopinfo->stop_reason = SPE_RUNTIME_EXCEPTION;
341                 stopinfo->result.spe_runtime_exception = run_status;
342                 stopinfo->spu_status = -1;
343                 errno = EIO;
344                 retval = -1;
345
346         } else if (run_rc & SPE_SPU_INVALID_CHANNEL) {
347                 DEBUG_PRINTF("SPU has tried to access an invalid "
348                                 "channel. %d\n", run_rc);
349                 stopinfo->stop_reason = SPE_RUNTIME_ERROR;
350                 stopinfo->result.spe_runtime_error =
    SPE_SPU_INVALID_CHANNEL;
351                 errno = EFAULT;
352                 retval = -1;
353
354         } else {
355                 DEBUG_PRINTF("spu_run returned invalid data: 0x%04x\n", run_rc);
356                 stopinfo->stop_reason = SPE_RUNTIME_FATAL;
357                 stopinfo->result.spe_runtime_fatal = -1;
358                 stopinfo->spu_status = -1;
359                 errno = EFAULT;
360                 retval = -1;
361
362         }
363
364         freespeinfo();
365         return retval;
366 }
```

Here is the call graph for this function:



void _base_spe_context_unlock (spe_context_ptr_t *spe*, enum fd_name *fd*)

_base_spe_context_unlock unlocks members of the SPE context

Parameters

spectx	Specifies the SPE context
fd	Specifies the file

Definition at line 96 of file create.c.
References spe_context::base_private, and spe_context_base_priv::fd_lock.
Referenced by _base_spe_close_if_open(), and _base_spe_open_if_closed().

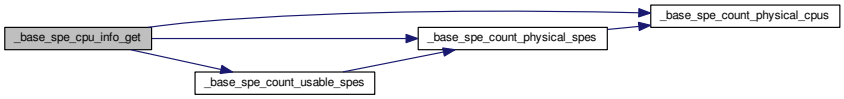
```
97 {
98         pthread_mutex_unlock(&spe->base_private->fd_lock[fdesc]);
99 }
```

int _base_spe_cpu_info_get (int *info_requested*, int *cpu_node*)

_base_spe_info_get
Definition at line 105 of file info.c.
References _base_spe_count_physical_cpus(), _base_spe_count_physical_spes(), _base_spe_count_usable_spes(), SPE_COUNT_PHYSICAL_CPU_NODES, SPE_COUNT_PHYSICAL_SPES, and SPE_COUNT_USABLE_SPES.

```
105                                                         {
106         int ret = 0;
107         errno = 0;
108
109         switch (info_requested) {
110         case  SPE_COUNT_PHYSICAL_CPU_NODES:
111                 ret = _base_spe_count_physical_cpus(cpu_node);
112                 break;
113         case SPE_COUNT_PHYSICAL_SPES:
114                 ret = _base_spe_count_physical_spes(cpu_node);
115                 break;
116         case SPE_COUNT_USABLE_SPES:
117                 ret = _base_spe_count_usable_spes(cpu_node);
118                 break;
119         default:
120                 errno = EINVAL;
121                 ret = -1;
122         }
123         return ret;
124 }
```

Here is the call graph for this function:



int _base_spe_emulated_loader_present (void)

Check if the emulated loader is present in the filesystem

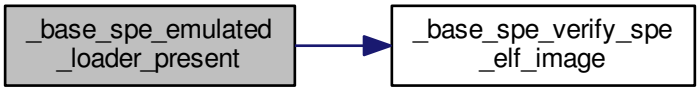
Returns

Non-zero if the loader is available, otherwise zero.

Definition at line 159 of file load.c.
References _base_spe_verify_spe_elf_image().
Referenced by _base_spe_context_create().

```
160 {
161         spe_program_handle_t *loader = emulated_loader_program();
162
163         if (!loader)
164                 return 0;
165
166         return !_base_spe_verify_spe_elf_image(loader);
167 }
```

Here is the call graph for this function:



spe_gang_context_ptr_t _base_spe_gang_context_create (unsigned int *flags*)

creates the directory in SPUFS that will contain all SPEs that are considered a gang Note: I would like to generalize this to a ”group” or ”set” Additional attributes maintained at the group level should be used to define scheduling constraints such ”temporal” (e.g., scheduled all at the same time, i.e., a gang) ”topology” (e.g., ”closeness” of SPEs for optimal communication)

Definition at line 376 of file create.c.

References spe_gang_context::base_private, DEBUG_PRINTF, and spe_gang_context_base_priv::gangname.

```
377 {
378         char pathname[256];
379         struct spe_gang_context_base_priv *pgctx = NULL;
380         struct spe_gang_context *gctx = NULL;
381
382         gctx = malloc(sizeof(*gctx));
383         if (!gctx) {
384                 DEBUG_PRINTF("ERROR: Could not allocate spe context.\n");
385                 return NULL;
386         }
387         memset(gctx, 0, sizeof(*gctx));
388
389         pgctx = malloc(sizeof(*pgctx));
390         if (!pgctx) {
391                 DEBUG_PRINTF("ERROR: Could not allocate spe context.\n");
392                 free(gctx);
393                 return NULL;
394         }
395         memset(pgctx, 0, sizeof(*pgctx));
396
397         gctx->base_private = pgctx;
398
399         sprintf(gctx->base_private->gangname, "gang-%i-%lu", getpid(),
400                         (unsigned long)gctx);
401         sprintf(pathname, "/spu/%s", gctx->base_private->gangname);
402
403         gctx->base_private->fd_gang_dir = spu_create(pathname, SPU_CREATE_GANG,
404                                 S_IRUSR | S_IWUSR | S_IXUSR);
405
406         if (gctx->base_private->fd_gang_dir < 0) {
407                 DEBUG_PRINTF("ERROR: Could not create Gang %s\n", pathname);
408                 free_spe_gang_context(gctx);
409                 errno = EFAULT;
410                 return NULL;
411         }
412
413         gctx->base_private->flags = flags;
```

```
414
415         return gctx;
416 }
```

int _base_spe_gang_context_destroy (spe_gang_context_ptr_t *gctx*)

_base_spe_gang_context_destroy destroys a gang context and frees associated resources
Parameters

gctx	Specifies the SPE gang context

Definition at line 427 of file create.c.

```
428 {
429         return free_spe_gang_context(gctx);
430 }
```

int _base_spe_image_close (spe_program_handle_t * *handle*)

_base_spe_image_close unmaps an SPE ELF object that was previously mapped using spe_open_image.
Parameters

handle	handle to open file

Return values

0	On success, spe_close_image returns 0.
-1	On failure, -1 is returned and errno is set appropriately. Possible values for errno: EINVAL From spe_close_image, this indicates that the file, specified by filename, was not previously mapped by a call to spe_open_image.

Definition at line 96 of file image.c.

References spe_program_handle::elf_image, image_handle::map_size, image_handle::speh, and spe_program_handle::toe_shadow.

```
97 {
98         int ret = 0;
99         struct image_handle *ih;
100
101         if (!handle) {
102                 errno = EINVAL;
103                 return -1;
104         }
105
106         ih = (struct image_handle *)handle;
107
108         if (!ih->speh.elf_image || !ih->map_size) {
109                 errno = EINVAL;
110                 return -1;
111         }
112
113         if (ih->speh.toe_shadow)
114                 free(ih->speh.toe_shadow);
115
116         ret = munmap(ih->speh.elf_image, ih->map_size );
117         free(handle);
118
119         return ret;
120 }
```

spe_program_handle_t* _base_spe_image_open (const char * *filename*)

_base_spe_image_open maps an SPE ELF executable indicated by filename into system memory and returns the mapped address appropriate for use by the spe_create_thread API. It is often more convenient/appropriate

to use the loading methodologies where SPE ELF objects are converted to PPE static or shared libraries with symbols which point to the SPE ELF objects after these special libraries are loaded. These libraries are then linked with the associated PPE code to provide a direct symbol reference to the SPE ELF object. The symbols in this scheme are equivalent to the address returned from the spe_open_image function. SPE ELF objects loaded using this function are not shared with other processes, but SPE ELF objects loaded using the other scheme, mentioned above, can be shared if so desired.

Parameters

filename	Specifies the filename of an SPE ELF executable to be loaded and mapped into system memory.

Returns

On success, spe_open_image returns the address at which the specified SPE ELF object has been mapped. On failure, NULL is returned and errno is set appropriately.
Possible values for errno include:
EACCES The calling process does not have permission to access the specified file.
EFAULT The filename parameter points to an address that was not contained in the calling process's address space.

A number of other errno values could be returned by the open(2), fstat(2), mmap(2), munmap(2), or close(2) system calls which may be utilized by the spe_open_image or spe_close_image functions.

See Also

spe_create_thread

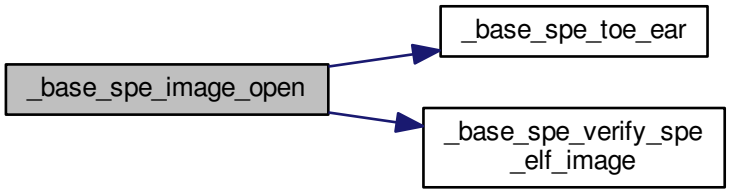
Definition at line 37 of file image.c.

References _base_spe_toe_ear(), _base_spe_verify_spe_elf_image(), spe_program_handle::elf_image, spe_program_handle::handle_size, image_handle::map_size, image_handle::speh, and spe_program_handle::toe_shadow.

```
38 {
39         /* allocate an extra integer in the spe handle to keep the mapped size information */
40         struct image_handle *ret;
41         int binfd = -1, f_stat;
42         struct stat statbuf;
43         size_t ps = getpagesize ();
44
45         ret = malloc(sizeof(struct image_handle));
46         if (!ret)
47                 return NULL;
48
49         ret->speh.handle_size = sizeof(spe_program_handle_t);
50         ret->speh.toe_shadow = NULL;
51
52         binfd = open(filename, O_RDONLY);
53         if (binfd < 0)
54                 goto ret_err;
55
56         f_stat = fstat(binfd, &statbuf);
57         if (f_stat < 0)
58                 goto ret_err;
59
60         /* Sanity: is it executable ?
61          */
62         if(!(statbuf.st_mode & (S_IXUSR | S_IXGRP | S_IXOTH))) {
63                 errno=EACCES;
64                 goto ret_err;
65         }
66
67         /* now store the size at the extra allocated space */
68         ret->map_size = (statbuf.st_size + ps - 1) & ~(ps - 1);
69
70         ret->speh.elf_image = mmap(NULL, ret->map_size,
71                                                         PROT_WRITE | PROT_READ,
72                                                         MAP_PRIVATE, binfd, 0);
73         if (ret->speh.elf_image == MAP_FAILED)
```

```
74                goto ret_err;
75
76        /*Verify that this is a valid SPE ELF object*/
77        if((_base_spe_verify_spe_elf_image((
    spe_program_handle_t *)ret)))
78                goto ret_err;
79
80        if (_base_spe_toe_ear(&ret->speh))
81                goto ret_err;
82
83        /* ok */
84        close(binfd);
85        return (spe_program_handle_t *)ret;
86
87        /* err & cleanup */
88 ret_err:
89        if (binfd >= 0)
90                close(binfd);
91
92        free(ret);
93        return NULL;
94 }
```

Here is the call graph for this function:



int _base_spe_in_mbox_status (spe_context_ptr_t *spectx*)

The _base_spe_in_mbox_status function fetches the status of the SPU inbound mailbox for the SPE thread specified by the speid parameter. A 0 value is return if the mailbox is full. A non-zero value specifies the number of available (32-bit) mailbox entries.

Parameters

spectx	Specifies the SPE context whose mailbox status is to be read.

Returns

On success, returns the current status of the mailbox, respectively. On failure, -1 is returned.

See Also

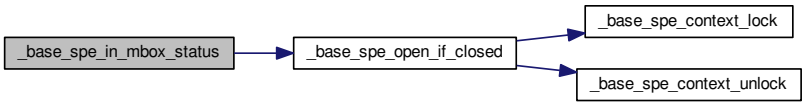
spe_read_out_mbox, spe_write_in_mbox, read (2)

Definition at line 202 of file mbox.c.

References _base_spe_open_if_closed(), spe_context::base_private, spe_context_base_priv::cntl_mmap_base, FD_WBOX_STAT, spe_context_base_priv::flags, SPE_MAP_PS, and spe_spu_control_area::SPU_Mbox_Stat.

```
203 {
204         int rc, ret;
205         volatile struct spe_spu_control_area *cntl_area =
206                 spectx->base_private->cntl_mmap_base;
207
208         if (spectx->base_private->flags & SPE_MAP_PS) {
209                 ret = (cntl_area->SPU_Mbox_Stat >> 8) & 0xFF;
210         } else {
211                 rc = read(_base_spe_open_if_closed(spectx,
    FD_WBOX_STAT, 0), &ret, 4);
212                 if (rc != 4)
213                         ret = -1;
214         }
215
216         return ret;
217
218 }
```

Here is the call graph for this function:



int _base_spe_in_mbox_write (spe_context_ptr_t *spectx,* unsigned int *mbox_data[ ],* int *count,* int *behavior_flag*)

The _base_spe_in_mbox_write function writes mbox_data to the SPE inbound mailbox for the SPE thread speid.

If the behavior flag indicates ALL_BLOCKING the call will try to write exactly count mailbox entries and block until the write request is satisfied, i.e., exactly count mailbox entries have been written. If the behavior flag indicates ANY_BLOCKING the call will try to write up to count mailbox entries, and block until the write request is satisfied, i.e., at least 1 mailbox entry has been written. If the behavior flag indicates ANY_NON_BLOCKING the call will not block until the write request is satisfied, but instead write whatever is immediately possible and return the number of mailbox entries written. spe_stat_in_mbox can be called to ensure that data can be written prior to calling the function.

Parameters

spectx	Specifies the SPE thread whose outbound mailbox is to be read.
mbox_data	
count	
behavior_flag	ALL_BLOCKING ANY_BLOCKING ANY_NON_BLOCKING

Return values

>=0	the number of 32-bit mailbox messages written

-1	error condition and errno is set Possible values for errno: EINVAL spectx is invalid Exxxx what else do we need here??

void* _base_spe_ls_area_get (struct spe_context * *spectx*)

_base_spe_ls_area_get returns a pointer to the start of the memory mapped local store area
Parameters

spectx	Specifies the SPE context

int _base_spe_ls_size_get (spe_context_ptr_t *spe*)

_base_spe_ls_size_get returns the size of the local store area
Parameters

spectx	Specifies the SPE context

Definition at line 105 of file accessors.c.
References LS_SIZE.

```
106 {
107         return LS_SIZE;
108 }
```

int _base_spe_mfcio_get (spe_context_ptr_t *spectx*, unsigned int *ls*, void * *ea*, unsigned int *size*, unsigned int *tag*, unsigned int *tid*, unsigned int *rid*)

The _base_spe_mfcio_get function places a get DMA command on the proxy command queue of the SPE thread specified by speid. The get command transfers size bytes of data starting at the effective address specified by ea to the local store address specified by ls. The DMA is identified by the tag id specified by tag and performed according to the transfer class and replacement class specified by tid and rid respectively.
Parameters

spectx	Specifies the SPE context
ls	Specifies the starting local store destination address.
ea	Specifies the starting effective address source address.
size	Specifies the size, in bytes, to be transferred.
tag	Specifies the tag id used to identify the DMA command.
tid	Specifies the transfer class identifier of the DMA command.
rid	Specifies the replacement class identifier of the DMA command.

Returns

On success, return 0. On failure, -1 is returned.

Definition at line 160 of file dma.c.
References MFC_CMD_GET.

```
167 {
168         return spe_do_mfc_get(spectx, ls, ea, size, tag, tid, rid, MFC_CMD_GET);
169 }
```

int _base_spe_mfcio_getb (spe_context_ptr_t *spectx*, unsigned int *ls*, void * *ea*, unsigned int *size*, unsigned int *tag*, unsigned int *tid*, unsigned int *rid*)

The _base_spe_mfcio_getb function is identical to _base_spe_mfcio_get except that it places a getb (get with barrier) DMA command on the proxy command queue. The barrier form ensures that this command and all sequence commands with the same tag identifier as this command are locally ordered with respect to all previously issued commands with the same tag group and command queue.

Parameters

spectx	Specifies the SPE context
ls	Specifies the starting local store destination address.
ea	Specifies the starting effective address source address.
size	Specifies the size, in bytes, to be transferred.
tag	Specifies the tag id used to identify the DMA command.
tid	Specifies the transfer class identifier of the DMA command.
rid	Specifies the replacement class identifier of the DMA command.

Returns

On success, return 0. On failure, -1 is returned.

Definition at line 171 of file dma.c.
References MFC_CMD_GETB.

```
178 {
179         return spe_do_mfc_get(spectx, ls, ea, size, tag, rid, rid, MFC_CMD_GETB);
180 }
```

int _base_spe_mfcio_getf (spe_context_ptr_t *spectx*, unsigned int *ls*, void * *ea*, unsigned int *size*, unsigned int *tag*, unsigned int *tid*, unsigned int *rid*)

The _base_spe_mfcio_getf function is identical to _base_spe_mfcio_get except that it places a getf (get with fence) DMA command on the proxy command queue. The fence form ensure that this command is locally ordered with respect to all previously issued commands with the same tag group and command queue.

Parameters

spectx	Specifies the SPE context
ls	Specifies the starting local store destination address.
ea	Specifies the starting effective address source address.
size	Specifies the size, in bytes, to be transferred.
tag	Specifies the tag id used to identify the DMA command.
tid	Specifies the transfer class identifier of the DMA command.
rid	Specifies the replacement class identifier of the DMA command.

Returns

On success, return 0. On failure, -1 is returned.

Definition at line 182 of file dma.c.
References MFC_CMD_GETF.

```
189 {
190         return spe_do_mfc_get(spectx, ls, ea, size, tag, tid, rid, MFC_CMD_GETF);
191 }
```

int _base_spe_mfcio_put (spe_context_ptr_t *spectx*, unsigned int *ls*, void * *ea*, unsigned int *size*, unsigned int *tag*, unsigned int *tid*, unsigned int *rid*)

The _base_spe_mfcio_put function places a put DMA command on the proxy command queue of the SPE thread specified by speid. The put command transfers size bytes of data starting at the local store address specified by ls to the effective address specified by ea. The DMA is identified by the tag id specified by tag and performed according transfer class and replacement class specified by tid and rid respectively.

Parameters

spectx	Specifies the SPE context
ls	Specifies the starting local store destination address.
ea	Specifies the starting effective address source address.
size	Specifies the size, in bytes, to be transferred.
tag	Specifies the tag id used to identify the DMA command.
tid	Specifies the transfer class identifier of the DMA command.
rid	Specifies the replacement class identifier of the DMA command.

Returns

On success, return 0. On failure, -1 is returned.

Definition at line 126 of file dma.c.
References MFC_CMD_PUT.

```
133 {
134         return spe_do_mfc_put(spectx, ls, ea, size, tag, tid, rid, MFC_CMD_PUT);
135 }
```

int _base_spe_mfcio_putb (spe_context_ptr_t *spectx*, unsigned int *ls*, void * *ea*, unsigned int *size*, unsigned int *tag*, unsigned int *tid*, unsigned int *rid*)

The _base_spe_mfcio_putb function is identical to _base_spe_mfcio_put except that it places a putb (put with barrier) DMA command on the proxy command queue. The barrier form ensures that this command and all sequence commands with the same tag identifier as this command are locally ordered with respect to all previously i ssued commands with the same tag group and command queue.

Parameters

spectx	Specifies the SPE context
ls	Specifies the starting local store destination address.
ea	Specifies the starting effective address source address.
size	Specifies the size, in bytes, to be transferred.
tag	Specifies the tag id used to identify the DMA command.
tid	Specifies the transfer class identifier of the DMA command.
rid	Specifies the replacement class identifier of the DMA command.

Returns

On success, return 0. On failure, -1 is returned.

Definition at line 137 of file dma.c.
References MFC_CMD_PUTB.

```
144 {
145         return spe_do_mfc_put(spectx, ls, ea, size, tag, tid, rid, MFC_CMD_PUTB);
146 }
```

int _base_spe_mfcio_putf (spe_context_ptr_t *spectx*, unsigned int *ls*, void * *ea*, unsigned int *size*, unsigned int *tag*, unsigned int *tid*, unsigned int *rid*)

The _base_spe_mfcio_putf function is identical to _base_spe_mfcio_put except that it places a putf (put with fence) DMA command on the proxy command queue. The fence form ensures that this command is locally ordered with respect to all previously issued commands with the same tag group and command queue.
Parameters

spectx	Specifies the SPE context
ls	Specifies the starting local store destination address.
ea	Specifies the starting effective address source address.
size	Specifies the size, in bytes, to be transferred.
tag	Specifies the tag id used to identify the DMA command.
tid	Specifies the transfer class identifier of the DMA command.
rid	Specifies the replacement class identifier of the DMA command.

Returns

On success, return 0. On failure, -1 is returned.

Definition at line 148 of file dma.c.
References MFC_CMD_PUTF.

```
155 {
156         return spe_do_mfc_put(spectx, ls, ea, size, tag, tid, rid, MFC_CMD_PUTF);
157 }
```

int _base_spe_mfcio_tag_status_read (spe_context_ptr_t *spectx*, unsigned int *mask*, unsigned int *behavior*, unsigned int * *tag_status*)

_base_spe_mfcio_tag_status_read
No Idea
Definition at line 307 of file dma.c.
References spe_context_base_priv::active_tagmask, spe_context::base_private, spe_context_base_priv::flags, SPE_MAP_PS, SPE_TAG_ALL, SPE_TAG_ANY, and SPE_TAG_IMMEDIATE.

```
308 {
309         if ( mask != 0 ) {
310                 if (!(spectx->base_private->flags & SPE_MAP_PS))
311                         mask = 0;
312         } else {
313                 if ((spectx->base_private->flags & SPE_MAP_PS))
314                         mask = spectx->base_private->active_tagmask;
315         }
316
317         if (!tag_status) {
318                 errno = EINVAL;
319                 return -1;
320         }
321
322         switch (behavior) {
323         case SPE_TAG_ALL:
324                 return spe_mfcio_tag_status_read_all(spectx, mask, tag_status);
325         case SPE_TAG_ANY:
326                 return spe_mfcio_tag_status_read_any(spectx, mask, tag_status);
327         case SPE_TAG_IMMEDIATE:
328                 return spe_mfcio_tag_status_read_immediate(spectx, mask, tag_status);
329         default:
330                 errno = EINVAL;
331                 return -1;
332         }
333 }
```

int _base_spe_mssync_start (spe_context_ptr_t *spectx*)

_base_spe_mssync_start starts Multisource Synchronisation

Parameters

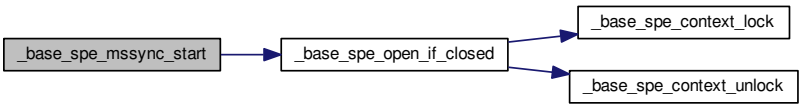
spectx	Specifies the SPE context

Definition at line 335 of file dma.c.

References _base_spe_open_if_closed(), spe_context::base_private, FD_MSS, spe_context_base_priv::flags, spe_mssync_area::MFC_MSSync, spe_context_base_priv::mssync_mmap_base, and SPE_MAP_PS.

```
336 {
337         int ret, fd;
338         unsigned int data = 1; /* Any value can be written here */
339
340         volatile struct spe_mssync_area *mss_area =
341                 spectx->base_private->mssync_mmap_base;
342
343         if (spectx->base_private->flags & SPE_MAP_PS) {
344                 mss_area->MFC_MSSync = data;
345                 return 0;
346         } else {
347                 fd = _base_spe_open_if_closed(spectx,
    FD_MSS, 0);
348                 if (fd != -1) {
349                         ret = write(fd, &data, sizeof (data));
350                         if ((ret < 0) && (errno != EIO)) {
351                                 perror("spe_mssync_start: internal error");
352                         }
353                         return ret < 0 ? -1 : 0;
354                 } else
355                         return -1;
356         }
357 }
```

Here is the call graph for this function:



int _base_spe_mssync_status (spe_context_ptr_t *spectx*)

_base_spe_mssync_status retrieves status of Multisource Synchronisation

Parameters

spectx	Specifies the SPE context

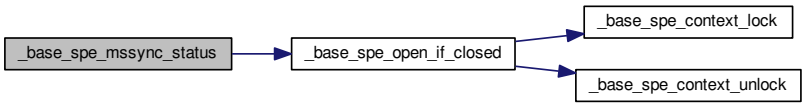
Definition at line 359 of file dma.c.

References _base_spe_open_if_closed(), spe_context::base_private, FD_MSS, spe_context_base_priv::flags, spe_mssync_area::MFC_MSSync, spe_context_base_priv::mssync_mmap_base, and SPE_MAP_PS.

```
360 {
361         int ret, fd;
362         unsigned int data;
363
364         volatile struct spe_mssync_area *mss_area =
365                 spectx->base_private->mssync_mmap_base;
366
367         if (spectx->base_private->flags & SPE_MAP_PS) {
368                 return  mss_area->MFC_MSSync;
369         } else {
370                 fd = _base_spe_open_if_closed(spectx,
    FD_MSS, 0);
371                 if (fd != -1) {
372                         ret = read(fd, &data, sizeof (data));
```

```
373                         if ((ret < 0) && (errno != EIO)) {
374                                 perror("spe_mssync_start: internal error");
375                         }
376                         return ret < 0 ? -1 : data;
377                 } else
378                         return -1;
379         }
380 }
```

Here is the call graph for this function:



int _base_spe_out_intr_mbox_read (spe_context_ptr_t *spectx*, unsigned int *mbox_data[ ]*, int *count*, int *behavior_flag*)

The _base_spe_out_intr_mbox_read function reads the contents of the SPE outbound interrupting mailbox for the SPE context.

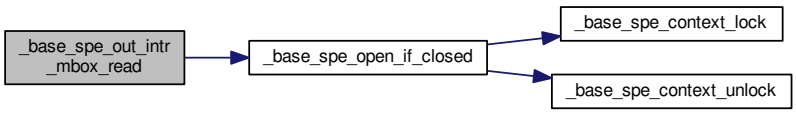
Definition at line 255 of file mbox.c.

References _base_spe_open_if_closed(), FD_IBOX, FD_IBOX_NB, SPE_MBOX_ALL_BLOCKING, SPE_MBOX_ANY_BLOCKING, and SPE_MBOX_ANY_NONBLOCKING.

```
259 {
260         int rc;
261         int total;
262
263         if (mbox_data == NULL || count < 1){
264                 errno = EINVAL;
265                 return -1;
266         }
267
268         switch (behavior_flag) {
269         case SPE_MBOX_ALL_BLOCKING: // read all, even if blocking
270                 total = rc = 0;
271                 while (total < 4*count) {
272                         rc = read(_base_spe_open_if_closed(spectx,
    FD_IBOX, 0),
273                                   (char *)mbox_data + total, 4*count - total);
274                         if (rc == -1) {
275                                 break;
276                         }
277                         total += rc;
278                 }
279                 break;
280
281         case  SPE_MBOX_ANY_BLOCKING: // read at least one, even if blocking
282                 total = rc = read(_base_spe_open_if_closed(spectx,
    FD_IBOX, 0), mbox_data, 4*count);
283                 break;
284
285         case  SPE_MBOX_ANY_NONBLOCKING: // only reaad, if non blocking
286                 rc = read(_base_spe_open_if_closed(spectx,
    FD_IBOX_NB, 0), mbox_data, 4*count);
287                 if (rc == -1 && errno == EAGAIN) {
288                         rc = 0;
289                         errno = 0;
290                 }
291                 total = rc;
292                 break;
293
294         default:
295                 errno = EINVAL;
```

```
296                 return -1;
297         }
298
299         if (rc == -1) {
300                 errno = EIO;
301                 return -1;
302         }
303
304         return rc / 4;
305 }
```

Here is the call graph for this function:



int _base_spe_out_intr_mbox_status (spe_context_ptr_t *spectx*)

The _base_spe_out_intr_mbox_status function fetches the status of the SPU outbound interrupt mailbox for the SPE thread specified by the speid parameter. A 0 value is return if the mailbox is empty. A non-zero value specifies the number of 32-bit unread mailbox entries.

Parameters

spectx	Specifies the SPE context whose mailbox status is to be read.

Returns

On success, returns the current status of the mailbox, respectively. On failure, -1 is returned.

See Also

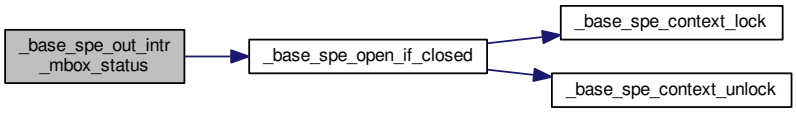
spe_read_out_mbox, spe_write_in_mbox, read (2)

Definition at line 238 of file mbox.c.

References _base_spe_open_if_closed(), spe_context::base_private, spe_context_base_priv::cntl_mmap_base, FD_IBOX_STAT, spe_context_base_priv::flags, SPE_MAP_PS, and spe_spu_control_area::SPU_Mbox_Stat.

```
239 {
240         int rc, ret;
241         volatile struct spe_spu_control_area *cntl_area =
242                 spectx->base_private->cntl_mmap_base;
243
244         if (spectx->base_private->flags & SPE_MAP_PS) {
245                 ret = (cntl_area->SPU_Mbox_Stat >> 16) & 0xFF;
246         } else {
247                 rc = read(_base_spe_open_if_closed(spectx,
    FD_IBOX_STAT, 0), &ret, 4);
248                 if (rc != 4)
249                         ret = -1;
250
251         }
252         return ret;
253 }
```

Here is the call graph for this function:



int _base_spe_out_mbox_read (spe_context_ptr_t *spectx,* unsigned int *mbox_data[ ],* int *count*)

The _base_spe_out_mbox_read function reads the contents of the SPE outbound interrupting mailbox for the SPE thread speid.

The call will not block until the read request is satisfied, but instead return up to count currently available mailbox entries.

spe_stat_out_intr_mbox can be called to ensure that data is available prior to reading the outbound interrupting mailbox.

Parameters

spectx	Specifies the SPE thread whose outbound mailbox is to be read.
mbox_data	
count	

Return values

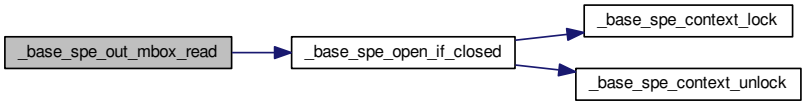
>0	the number of 32-bit mailbox messages read
=0	no data available
-1	error condition and errno is set Possible values for errno: EINVAL speid is invalid Exxxx what else do we need here??

Definition at line 58 of file mbox.c.

References _base_spe_open_if_closed(), spe_context::base_private, DEBUG_PRINTF, FD_MBOX, spe_context_base_priv::flags, and SPE_MAP_PS.

```
61 {
62         int rc;
63
64         if (mbox_data == NULL || count < 1){
65                 errno = EINVAL;
66                 return -1;
67         }
68
69         if (spectx->base_private->flags & SPE_MAP_PS) {
70                 rc = _base_spe_out_mbox_read_ps(spectx, mbox_data, count);
71         } else {
72                 rc = read(_base_spe_open_if_closed(spectx,
     FD_MBOX, 0), mbox_data, count*4);
73                 DEBUG_PRINTF("%s read rc: %d\n", __FUNCTION__, rc);
74                 if (rc != -1) {
75                         rc /= 4;
76                 } else {
77                         if (errno == EAGAIN ) { // no data ready to be read
78                                 errno = 0;
79                                 rc = 0;
80                         }
81                 }
82         }
83         return rc;
84 }
```

Here is the call graph for this function:



int _base_spe_out_mbox_status (spe_context_ptr_t *spectx*)

The _base_spe_out_mbox_status function fetches the status of the SPU outbound mailbox for the SPE thread specified by the speid parameter. A 0 value is return if the mailbox is empty. A non-zero value specifies the number of 32-bit unread mailbox entries.

Parameters

spectx	Specifies the SPE context whose mailbox status is to be read.

Returns

On success, returns the current status of the mailbox, respectively. On failure, -1 is returned.

See Also

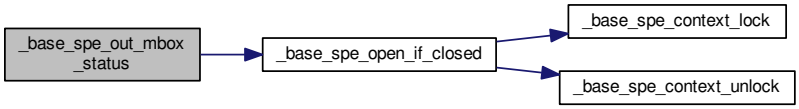
spe_read_out_mbox, spe_write_in_mbox, read (2)

Definition at line 220 of file mbox.c.

References _base_spe_open_if_closed(), spe_context::base_private, spe_context_base_priv::cntl_mmap_base, FD_MBOX_STAT, spe_context_base_priv::flags, SPE_MAP_PS, and spe_spu_control_area::SPU_Mbox_Stat.

```
221 {
222         int rc, ret;
223         volatile struct spe_spu_control_area *cntl_area =
224                 spectx->base_private->cntl_mmap_base;
225
226         if (spectx->base_private->flags & SPE_MAP_PS) {
227                 ret = cntl_area->SPU_Mbox_Stat & 0xFF;
228         } else {
229                 rc = read(_base_spe_open_if_closed(spectx,
    FD_MBOX_STAT, 0), &ret, 4);
230                 if (rc != 4)
231                         ret = -1;
232         }
233
234         return ret;
235
236 }
```

Here is the call graph for this function:



int _base_spe_program_load (spe_context_ptr_t *spectx,* spe_program_handle_t * *program*)

_base_spe_program_load loads an ELF image into a context

Parameters

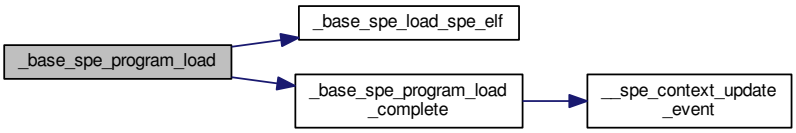
spectx	Specifies the SPE context
program	handle to the ELF image

Definition at line 203 of file load.c.

References _base_spe_load_spe_elf(), _base_spe_program_load_complete(), spe_context::base_private, DEBUG_PRINTF, spe_context_base_priv::emulated_entry, spe_ld_info::entry, spe_context_base_priv::entry, spe_context_base_priv::flags, spe_context_base_priv::loaded_program, spe_context_base_priv::mem_mmap_base, SPE_ISOLATE, and SPE_ISOLATE_EMULATE.

```
204 {
205         int rc = 0;
206         struct spe_ld_info ld_info;
207
208         spe->base_private->loaded_program = program;
209
210         if (spe->base_private->flags & SPE_ISOLATE) {
211                 rc = spe_start_isolated_app(spe, program);
212
213         } else if (spe->base_private->flags & SPE_ISOLATE_EMULATE) {
214                 rc = spe_start_emulated_isolated_app(spe, program, &ld_info);
215
216         } else {
217                 rc = _base_spe_load_spe_elf(program,
218                                 spe->base_private->mem_mmap_base, &ld_info);
219                 if (!rc)
220                         _base_spe_program_load_complete(spe);
221         }
222
223         if (rc != 0) {
224                 DEBUG_PRINTF ("Load SPE ELF failed..\n");
225                 return -1;
226         }
227
228         spe->base_private->entry = ld_info.entry;
229         spe->base_private->emulated_entry = ld_info.entry;
230
231         return 0;
232 }
```

Here is the call graph for this function:



void _base_spe_program_load_complete (spe_context_ptr_t *spectx*)

Signal that the program load has completed. For normal apps, this is called directly in the load path. For (emulated) isolated apps, the load is asynchronous, so this needs to be called when we know that the load has completed

Precondition

spe->base_priv->loaded_program is a valid SPE program

Parameters

spectx	The spe context that has been loaded.

Register the SPE program's start address with the oprofile and gdb, by writing to the object-id file.

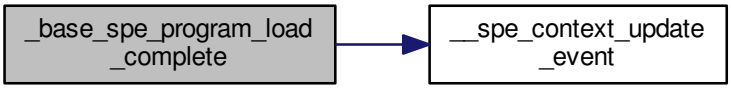
Definition at line 38 of file load.c.

References __spe_context_update_event(), spe_context::base_private, DEBUG_PRINTF, spe_program_handle::elf_image, spe_context_base_priv::fd_spe_dir, and spe_context_base_priv::loaded_program.

Referenced by _base_spe_context_run(), and _base_spe_program_load().

```
39 {
40         int objfd, len;
41         char buf[20];
42         spe_program_handle_t *program;
43
44         program = spectx->base_private->loaded_program;
45
46         if (!program || !program->elf_image) {
47                 DEBUG_PRINTF("%s called, but no program loaded\n", __func__);
48                 return;
49         }
50
51         objfd = openat(spectx->base_private->fd_spe_dir, "object-id", O_RDWR);
52         if (objfd < 0)
53                 return;
54
55         len = sprintf(buf, "%p", program->elf_image);
56         write(objfd, buf, len + 1);
57         close(objfd);
58
59         __spe_context_update_event();
60 }
```

Here is the call graph for this function:



void* _base_spe_ps_area_get (struct spe_context * *spectx*, enum ps_area *area*)

_base_spe_ps_area_get returns a pointer to the start of memory mapped problem state area

Parameters

spectx	Specifies the SPE context
area	specifes the area to map

int _base_spe_signal_write (spe_context_ptr_t *spectx*, unsigned int *signal_reg*, unsigned int *data*)

The _base_spe_signal_write function writes data to the signal notification register specified by signal_reg for the SPE thread specified by the speid parameter.

Parameters

spectx	Specifies the SPE context whose signal register is to be written to.
signal_reg	Specified the signal notification register to be written. Valid signal notification registers are: SPE_SIG_NOTIFY_REG_1 SPE signal notification register 1 SPE_SIG_NOTIFY_REG_2 SPE signal notification register 2
data	The 32-bit data to be written to the specified signal notification register.

Returns

On success, spe_write_signal returns 0. On failure, -1 is returned.

See Also

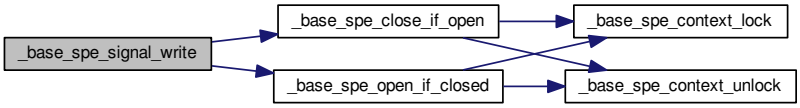
spe_get_ps_area, spe_write_in_mbox

Definition at line 307 of file mbox.c.

References _base_spe_close_if_open(), _base_spe_open_if_closed(), spe_context::base_private, FD_SIG1, FD_SIG2, spe_context_base_priv::flags, spe_context_base_priv::signal1_mmap_base, spe_context_base_priv::signal2_mmap_base, SPE_MAP_PS, SPE_SIG_NOTIFY_REG_1, SPE_SIG_NOTIFY_REG_2, spe_sig_notify_1_area::SPU_Sig_Notify_1, and spe_sig_notify_2_area::SPU_Sig_Notify_2.

```
310 {
311         int rc;
312
313         if (spectx->base_private->flags & SPE_MAP_PS) {
314                 if (signal_reg == SPE_SIG_NOTIFY_REG_1) {
315                         spe_sig_notify_1_area_t *sig = spectx->
    base_private->signal1_mmap_base;
316
317                         sig->SPU_Sig_Notify_1 = data;
318                 } else if (signal_reg == SPE_SIG_NOTIFY_REG_2) {
319                         spe_sig_notify_2_area_t *sig = spectx->
    base_private->signal2_mmap_base;
320
321                         sig->SPU_Sig_Notify_2 = data;
322                 } else {
323                         errno = EINVAL;
324                         return -1;
325                 }
326                 rc = 0;
327         } else {
328                 if (signal_reg == SPE_SIG_NOTIFY_REG_1)
329                         rc = write(_base_spe_open_if_closed(spectx,
    FD_SIG1, 0), &data, 4);
330                 else if (signal_reg == SPE_SIG_NOTIFY_REG_2)
331                         rc = write(_base_spe_open_if_closed(spectx,
    FD_SIG2, 0), &data, 4);
332                 else {
333                         errno = EINVAL;
334                         return -1;
335                 }
336
337                 if (rc == 4)
338                         rc = 0;
339
340                 if (signal_reg == SPE_SIG_NOTIFY_REG_1)
341                         _base_spe_close_if_open(spectx,
    FD_SIG1);
342                 else if (signal_reg == SPE_SIG_NOTIFY_REG_2)
343                         _base_spe_close_if_open(spectx,
    FD_SIG2);
344         }
345
346         return rc;
347 }
```

Here is the call graph for this function:



int _base_spe_stop_reason_get (spe_context_ptr_t *spectx*)

_base_spe_stop_reason_get

Parameters

spectx	one thread for which to check why it was stopped

Return values

0	success - eventid and eventdata set appropriately
1	spe has not stopped after checking last, so no data was written to event
-1	an error has happened, event was not touched, errno gets set Possible vales for errno: EINVAL speid is invalid Exxxx what else do we need here??

int _base_spe_stop_status_get (spe_context_ptr_t *spectx*)

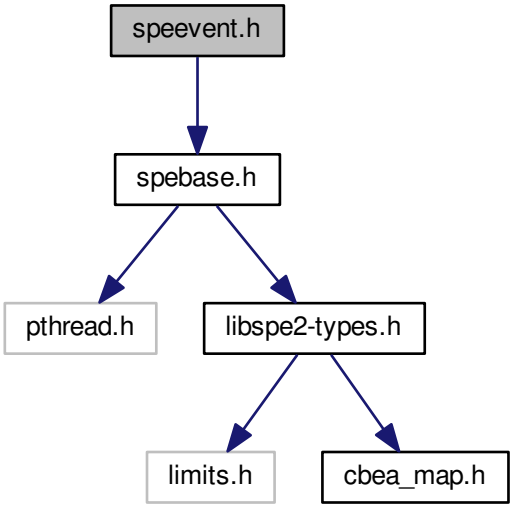
_base_spe_stop_status_get

Parameters

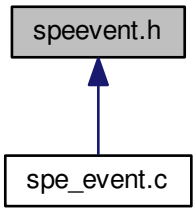
spectx	Specifies the SPE context

3.24 speevent.h File Reference

`#include "spebase.h"`
Include dependency graph for speevent.h:



This graph shows which files directly or indirectly include this file:



Data Structures

- struct spe_context_event_priv

Typedefs

- typedef struct spe_context_event_priv spe_context_event_priv_t

- typedef struct spe_context_event_priv * spe_context_event_priv_ptr_t

Enumerations

- enum __spe_event_types { __SPE_EVENT_OUT_INTR_MBOX, __SPE_EVENT_IN_MBOX, __SPE_EVENT_TAG_GROUP, __SPE_EVENT_SPE_STOPPED, __NUM_SPE_EVENT_TYPES }

Functions

- int _event_spe_stop_info_read (spe_context_ptr_t spe, spe_stop_info_t *stopinfo)
- spe_event_handler_ptr_t _event_spe_event_handler_create (void)
- int _event_spe_event_handler_destroy (spe_event_handler_ptr_t evhandler)
- int _event_spe_event_handler_register (spe_event_handler_ptr_t evhandler, spe_event_unit_t *event)
- int _event_spe_event_handler_deregister (spe_event_handler_ptr_t evhandler, spe_event_unit_t *event)
- int _event_spe_event_wait (spe_event_handler_ptr_t evhandler, spe_event_unit_t *events, int max_events, int timeout)
- int _event_spe_context_finalize (spe_context_ptr_t spe)
- struct spe_context_event_priv * _event_spe_context_initialize (spe_context_ptr_t spe)
- int _event_spe_context_run (spe_context_ptr_t spe, unsigned int *entry, unsigned int runflags, void *argp, void *envp, spe_stop_info_t *stopinfo)
- void _event_spe_context_lock (spe_context_ptr_t spe)
- void _event_spe_context_unlock (spe_context_ptr_t spe)

3.24.1 Typedef Documentation

typedef struct spe_context_event_priv * spe_context_event_priv_ptr_t

typedef struct spe_context_event_priv spe_context_event_priv_t

3.24.2 Enumeration Type Documentation

enum __spe_event_types

Enumerator

__SPE_EVENT_OUT_INTR_MBOX

__SPE_EVENT_IN_MBOX

__SPE_EVENT_TAG_GROUP

__SPE_EVENT_SPE_STOPPED

__NUM_SPE_EVENT_TYPES

Definition at line 28 of file speevent.h.

```
28                      {
29   __SPE_EVENT_OUT_INTR_MBOX, __SPE_EVENT_IN_MBOX,
30   __SPE_EVENT_TAG_GROUP, __SPE_EVENT_SPE_STOPPED,
31   __NUM_SPE_EVENT_TYPES
32 };
```

3.24.3 Function Documentation

int _event_spe_context_finalize (spe_context_ptr_t *spe*)

Definition at line 416 of file spe_event.c.

References __SPE_EVENT_CONTEXT_PRIV_GET, __SPE_EVENT_CONTEXT_PRIV_SET, spe_context_event_priv::lock, spe_context_event_priv::stop_event_pipe, and spe_context_event_priv::stop_event_read_lock.

```
417 {
418   spe_context_event_priv_ptr_t evctx;
419
420   if (!spe) {
421     errno = ESRCH;
422     return -1;
423   }
424
425   evctx = __SPE_EVENT_CONTEXT_PRIV_GET(spe);
426   __SPE_EVENT_CONTEXT_PRIV_SET(spe, NULL);
427
428   close(evctx->stop_event_pipe[0]);
429   close(evctx->stop_event_pipe[1]);
430
431   pthread_mutex_destroy(&evctx->lock);
432   pthread_mutex_destroy(&evctx->stop_event_read_lock);
433
434   free(evctx);
435
436   return 0;
437 }
```

struct spe_context_event_priv* _event_spe_context_initialize (spe_context_ptr_t *spe*)

Definition at line 439 of file spe_event.c.

References spe_context_event_priv::events, spe_context_event_priv::lock, spe_event_unit::spe, spe_context_event_priv::stop_event_pipe, and spe_context_event_priv::stop_event_read_lock.

```
440 {
441   spe_context_event_priv_ptr_t evctx;
442   int rc;
443   int i;
444
445   evctx = calloc(1, sizeof(*evctx));
446   if (!evctx) {
447     return NULL;
448   }
449
450   rc = pipe(evctx->stop_event_pipe);
451   if (rc == -1) {
452     free(evctx);
453     return NULL;
454   }
455   rc = fcntl(evctx->stop_event_pipe[0], F_GETFL);
456   if (rc != -1) {
457     rc = fcntl(evctx->stop_event_pipe[0], F_SETFL, rc | O_NONBLOCK);
458   }
459   if (rc == -1) {
460     close(evctx->stop_event_pipe[0]);
461     close(evctx->stop_event_pipe[1]);
462     free(evctx);
463     errno = EIO;
464     return NULL;
465   }
466
467   for (i = 0; i < sizeof(evctx->events) / sizeof(evctx->events[0]); i++) {
468     evctx->events[i].spe = spe;
469   }
470
471   pthread_mutex_init(&evctx->lock, NULL);
472   pthread_mutex_init(&evctx->stop_event_read_lock, NULL);
473
474   return evctx;
475 }
```

void _event_spe_context_lock (spe_context_ptr_t *spe*)

Definition at line 49 of file spe_event.c.

References __SPE_EVENT_CONTEXT_PRIV_GET.

Referenced by _event_spe_event_handler_deregister(), _event_spe_event_handler_register(), and _event_spe_event_wait().

```
50 {
51   pthread_mutex_lock(&__SPE_EVENT_CONTEXT_PRIV_GET(spe)->lock);
52 }
```

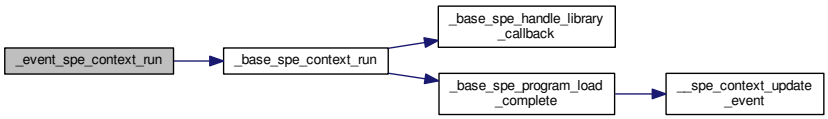
int _event_spe_context_run (spe_context_ptr_t *spe*, unsigned int * *entry*, unsigned int *runflags*, void * *argp*, void * *envp*, spe_stop_info_t * *stopinfo*)

Definition at line 477 of file spe_event.c.

References __SPE_EVENT_CONTEXT_PRIV_GET, _base_spe_context_run(), and spe_context_event_priv::stop_event_pipe.

```
478 {
479   spe_context_event_priv_ptr_t evctx;
480   spe_stop_info_t stopinfo_buf;
481   int rc;
482
483   if (!stopinfo) {
484     stopinfo = &stopinfo_buf;
485   }
486   rc = _base_spe_context_run(spe, entry, runflags, argp, envp, stopinfo);
487
488   evctx = __SPE_EVENT_CONTEXT_PRIV_GET(spe);
489   if (write(evctx->stop_event_pipe[1], stopinfo, sizeof(*stopinfo)) != sizeof(*stopinfo)) {
490     /* error check. */
491   }
492
493   return rc;
494 }
```

Here is the call graph for this function:



void _event_spe_context_unlock (spe_context_ptr_t *spe*)

Definition at line 54 of file spe_event.c.

References __SPE_EVENT_CONTEXT_PRIV_GET.

Referenced by _event_spe_event_handler_deregister(), _event_spe_event_handler_register(), and _event_spe_event_wait().

```
55 {
56   pthread_mutex_unlock(&__SPE_EVENT_CONTEXT_PRIV_GET(spe)->lock);
57 }
```

spe_event_handler_ptr_t _event_spe_event_handler_create (void)

Definition at line 110 of file spe_event.c.
References __SPE_EPOLL_FD_SET, and __SPE_EPOLL_SIZE.

```
111 {
112   int epfd;
113   spe_event_handler_t *evhandler;
114
115   evhandler = calloc(1, sizeof(*evhandler));
116   if (!evhandler) {
117     return NULL;
118   }
119
120   epfd = epoll_create(__SPE_EPOLL_SIZE);
121   if (epfd == -1) {
122     free(evhandler);
123     return NULL;
124   }
125
126   __SPE_EPOLL_FD_SET(evhandler, epfd);
127
128   return evhandler;
129 }
```

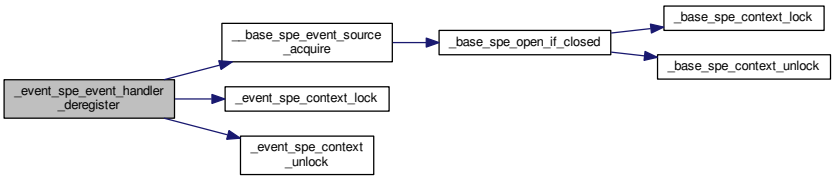
int _event_spe_event_handler_deregister (spe_event_handler_ptr_t *evhandler*, spe_event_unit_t * *event*)

Definition at line 273 of file spe_event.c.
References __base_spe_event_source_acquire(), __SPE_EPOLL_FD_GET, __SPE_EVENT_ALL, __SPE_EVENT_CONTEXT_PRIV_GET, __SPE_EVENT_IN_MBOX, __SPE_EVENT_OUT_INTR_MBOX, __SPE_EVENT_SPE_STOPPED, __SPE_EVENT_TAG_GROUP, __SPE_EVENTS_ENABLED, _event_spe_context_lock(), _event_spe_context_unlock(), spe_context_event_priv::events, spe_event_unit::events, FD_IBOX, FD_MFC, FD_WBOX, spe_event_unit::spe, SPE_EVENT_IN_MBOX, SPE_EVENT_OUT_INTR_MBOX, SPE_EVENT_SPE_STOPPED, SPE_EVENT_TAG_GROUP, and spe_context_event_priv::stop_event_pipe.

```
274 {
275   int epfd;
276   const int ep_op = EPOLL_CTL_DEL;
277   spe_context_event_priv_ptr_t evctx;
278   int fd;
279
280   if (!evhandler) {
281     errno = ESRCH;
282     return -1;
283   }
284   if (!event || !event->spe) {
285     errno = EINVAL;
286     return -1;
287   }
288   if (!__SPE_EVENTS_ENABLED(event->spe)) {
289     errno = ENOTSUP;
290     return -1;
291   }
292
293   epfd = __SPE_EPOLL_FD_GET(evhandler);
294   evctx = __SPE_EVENT_CONTEXT_PRIV_GET(event->spe);
295
296   if (event->events & ~__SPE_EVENT_ALL) {
297     errno = ENOTSUP;
298     return -1;
299   }
300
301   _event_spe_context_lock(event->spe); /* for spe->event_private->events */
302
303   if (event->events & SPE_EVENT_OUT_INTR_MBOX) {
304     fd = __base_spe_event_source_acquire(event->
    spe, FD_IBOX);
305     if (fd == -1) {
306       _event_spe_context_unlock(event->spe);
307       return -1;
308     }
309     if (epoll_ctl(epfd, ep_op, fd, NULL) == -1) {
```

```
310       __event_spe_context_unlock(event->spe);
311       return -1;
312     }
313     evctx->events[__SPE_EVENT_OUT_INTR_MBOX].
    events = 0;
314   }
315
316   if (event->events & SPE_EVENT_IN_MBOX) {
317     fd = __base_spe_event_source_acquire(event->
    spe, FD_WBOX);
318     if (fd == -1) {
319       __event_spe_context_unlock(event->spe);
320       return -1;
321     }
322     if (epoll_ctl(epfd, ep_op, fd, NULL) == -1) {
323       __event_spe_context_unlock(event->spe);
324       return -1;
325     }
326     evctx->events[__SPE_EVENT_IN_MBOX].events = 0;
327   }
328
329   if (event->events & SPE_EVENT_TAG_GROUP) {
330     fd = __base_spe_event_source_acquire(event->
    spe, FD_MFC);
331     if (fd == -1) {
332       __event_spe_context_unlock(event->spe);
333       return -1;
334     }
335     if (epoll_ctl(epfd, ep_op, fd, NULL) == -1) {
336       __event_spe_context_unlock(event->spe);
337       return -1;
338     }
339     evctx->events[__SPE_EVENT_TAG_GROUP].events = 0;
340   }
341
342   if (event->events & SPE_EVENT_SPE_STOPPED) {
343     fd = evctx->stop_event_pipe[0];
344     if (epoll_ctl(epfd, ep_op, fd, NULL) == -1) {
345       __event_spe_context_unlock(event->spe);
346       return -1;
347     }
348     evctx->events[__SPE_EVENT_SPE_STOPPED].events = 0;
349   }
350
351   __event_spe_context_unlock(event->spe);
352
353   return 0;
354 }
```

Here is the call graph for this function:



int __event_spe_event_handler_destroy (spe_event_handler_ptr_t *evhandler*)

Definition at line 135 of file spe_event.c.
References __SPE_EPOLL_FD_GET.

```
136 {
137   int epfd;
138
139   if (!evhandler) {
```

```
140     errno = ESRCH;
141     return -1;
142   }
143
144   epfd = __SPE_EPOLL_FD_GET(evhandler);
145   close(epfd);
146
147   free(evhandler);
148   return 0;
149 }
```

int _event_spe_event_handler_register (spe_event_handler_ptr_t *evhandler,* spe_event_unit_t * *event*)

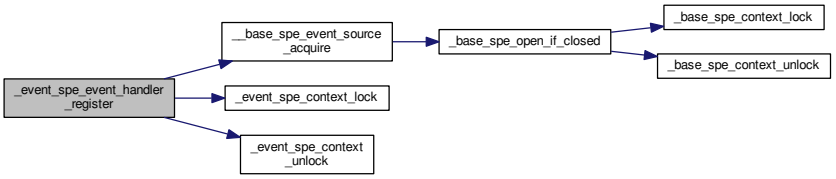
Definition at line 155 of file spe_event.c.

References __base_spe_event_source_acquire(), __SPE_EPOLL_FD_GET, __SPE_EVENT_ALL, __SPE_EVENT_CONTEXT_PRIV_GET, __SPE_EVENT_IN_MBOX, __SPE_EVENT_OUT_INTR_MBOX, __SPE_EVENT_SPE_STOPPED, __SPE_EVENT_TAG_GROUP, __SPE_EVENTS_ENABLED, _event_spe_context_lock(), _event_spe_context_unlock(), spe_context::base_private, spe_event_unit::data, spe_context_event_priv::events, spe_event_unit::events, FD_IBOX, FD_MFC, FD_WBOX, spe_context_base_priv::flags, spe_event_data::ptr, spe_event_unit::spe, SPE_EVENT_IN_MBOX, SPE_EVENT_OUT_INTR_MBOX, SPE_EVENT_SPE_STOPPED, SPE_EVENT_TAG_GROUP, SPE_MAP_PS, and spe_context_event_priv::stop_event_pipe.

```
156 {
157   int epfd;
158   const int ep_op = EPOLL_CTL_ADD;
159   spe_context_event_priv_ptr_t evctx;
160   spe_event_unit_t *ev_buf;
161   struct epoll_event ep_event;
162   int fd;
163
164   if (!evhandler) {
165     errno = ESRCH;
166     return -1;
167   }
168   if (!event || !event->spe) {
169     errno = EINVAL;
170     return -1;
171   }
172   if (!__SPE_EVENTS_ENABLED(event->spe)) {
173     errno = ENOTSUP;
174     return -1;
175   }
176
177   epfd = __SPE_EPOLL_FD_GET(evhandler);
178   evctx = __SPE_EVENT_CONTEXT_PRIV_GET(event->spe);
179
180   if (event->events & ~__SPE_EVENT_ALL) {
181     errno = ENOTSUP;
182     return -1;
183   }
184
185   _event_spe_context_lock(event->spe); /* for spe->event_private->events */
186
187   if (event->events & SPE_EVENT_OUT_INTR_MBOX) {
188     fd = __base_spe_event_source_acquire(event->
      spe, FD_IBOX);
189     if (fd == -1) {
190       _event_spe_context_unlock(event->spe);
191       return -1;
192     }
193
194     ev_buf = &evctx->events[__SPE_EVENT_OUT_INTR_MBOX];
195     ev_buf->events = SPE_EVENT_OUT_INTR_MBOX;
196     ev_buf->data = event->data;
197
198     ep_event.events = EPOLLIN;
199     ep_event.data.ptr = ev_buf;
200     if (epoll_ctl(epfd, ep_op, fd, &ep_event) == -1) {
201       _event_spe_context_unlock(event->spe);
202       return -1;
203     }
204   }
```

```
205
206   if (event->events & SPE_EVENT_IN_MBOX) {
207     fd = __base_spe_event_source_acquire(event->
      spe, FD_WBOX);
208     if (fd == -1) {
209       __event_spe_context_unlock(event->spe);
210       return -1;
211     }
212
213     ev_buf = &evctx->events[__SPE_EVENT_IN_MBOX];
214     ev_buf->events = SPE_EVENT_IN_MBOX;
215     ev_buf->data = event->data;
216
217     ep_event.events = EPOLLOUT;
218     ep_event.data.ptr = ev_buf;
219     if (epoll_ctl(epfd, ep_op, fd, &ep_event) == -1) {
220       __event_spe_context_unlock(event->spe);
221       return -1;
222     }
223   }
224
225   if (event->events & SPE_EVENT_TAG_GROUP) {
226     fd = __base_spe_event_source_acquire(event->
      spe, FD_MFC);
227     if (fd == -1) {
228       __event_spe_context_unlock(event->spe);
229       return -1;
230     }
231
232     if (event->spe->base_private->flags & SPE_MAP_PS) {
233             __event_spe_context_unlock(event->spe);
234             errno = ENOTSUP;
235             return -1;
236     }
237
238     ev_buf = &evctx->events[__SPE_EVENT_TAG_GROUP];
239     ev_buf->events = SPE_EVENT_TAG_GROUP;
240     ev_buf->data = event->data;
241
242     ep_event.events = EPOLLIN;
243     ep_event.data.ptr = ev_buf;
244     if (epoll_ctl(epfd, ep_op, fd, &ep_event) == -1) {
245       __event_spe_context_unlock(event->spe);
246       return -1;
247     }
248   }
249
250   if (event->events & SPE_EVENT_SPE_STOPPED) {
251     fd = evctx->stop_event_pipe[0];
252
253     ev_buf = &evctx->events[__SPE_EVENT_SPE_STOPPED];
254     ev_buf->events = SPE_EVENT_SPE_STOPPED;
255     ev_buf->data = event->data;
256
257     ep_event.events = EPOLLIN;
258     ep_event.data.ptr = ev_buf;
259     if (epoll_ctl(epfd, ep_op, fd, &ep_event) == -1) {
260       __event_spe_context_unlock(event->spe);
261       return -1;
262     }
263   }
264
265   __event_spe_context_unlock(event->spe);
266
267   return 0;
268 }
```

Here is the call graph for this function:



int _event_spe_event_wait (spe_event_handler_ptr_t *evhandler*, spe_event_unit_t * *events*, int *max_events*, int *timeout*)

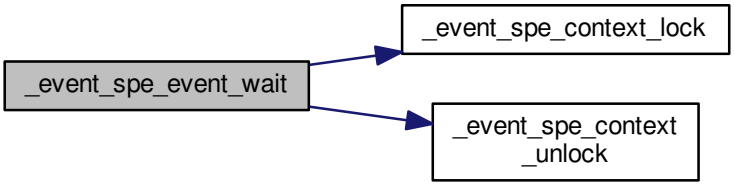
Definition at line 360 of file spe_event.c.

References __SPE_EPOLL_FD_GET, _event_spe_context_lock(), _event_spe_context_unlock(), and spe_event_unit::spe.

```
361 {
362   int epfd;
363   struct epoll_event *ep_events;
364   int rc;
365
366   if (!evhandler) {
367     errno = ESRCH;
368     return -1;
369   }
370   if (!events || max_events <= 0) {
371     errno = EINVAL;
372     return -1;
373   }
374
375   epfd = __SPE_EPOLL_FD_GET(evhandler);
376
377   ep_events = malloc(sizeof(*ep_events) * max_events);
378   if (!ep_events) {
379     return -1;
380   }
381
382   for ( ; ; ) {
383     rc = epoll_wait(epfd, ep_events, max_events, timeout);
384     if (rc == -1) { /* error */
385       if (errno == EINTR) {
386         if (timeout >= 0) { /* behave as timeout */
387           rc = 0;
388           break;
389         }
390         /* else retry */
391       }
392       else {
393         break;
394       }
395     }
396     else if (rc > 0) {
397       int i;
398       for (i = 0; i < rc; i++) {
399         spe_event_unit_t *ev = (spe_event_unit_t *)(ep_events[i].data.ptr);
400         _event_spe_context_lock(ev->spe); /* lock ev itself */
401         events[i] = *ev;
402         _event_spe_context_unlock(ev->spe);
403       }
404       break;
405     }
406     else { /* timeout */
407       break;
408     }
409   }
410
```

```
411   free(ep_events);
412
413   return rc;
414 }
```

Here is the call graph for this function:



int _event_spe_stop_info_read (spe_context_ptr_t *spe*, spe_stop_info_t * *stopinfo*)

Definition at line 59 of file spe_event.c.

References __SPE_EVENT_CONTEXT_PRIV_GET, spe_context_event_priv::stop_event_pipe, and spe_context_event_priv::stop_event_read_lock.

```
60 {
61   spe_context_event_priv_ptr_t evctx;
62   int rc;
63   int fd;
64   size_t total;
65
66   evctx = __SPE_EVENT_CONTEXT_PRIV_GET(spe);
67   fd = evctx->stop_event_pipe[0];
68
69   pthread_mutex_lock(&evctx->stop_event_read_lock); /* for atomic read */
70
71   rc = read(fd, stopinfo, sizeof(*stopinfo));
72   if (rc == -1) {
73     pthread_mutex_unlock(&evctx->stop_event_read_lock);
74     return -1;
75   }
76
77   total = rc;
78   while (total < sizeof(*stopinfo)) { /* this loop will be executed in few cases */
79     struct pollfd fds;
80     fds.fd = fd;
81     fds.events = POLLIN;
82     rc = poll(&fds, 1, -1);
83     if (rc == -1) {
84       if (errno != EINTR) {
85         break;
86       }
87     }
88     else if (rc == 1) {
89       rc = read(fd, (char *)stopinfo + total, sizeof(*stopinfo) - total);
90       if (rc == -1) {
91         if (errno != EAGAIN) {
92           break;
93         }
94       }
95       else {
96         total += rc;
97       }
98     }
99   }
100
```

```
101   pthread_mutex_unlock(&evctx->stop_event_read_lock);
102
103   return rc == -1 ? -1 : 0;
104 }
```

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