

---

# SPE Runtime Management Library

---

Version 2.0

September 24, 2013

©Copyright International Business Machines Corporation, Sony Computer Entertainment Incorporated, Toshiba Corporation 2003, 2004, 2005, 2006

All Rights Reserved

Printed in the United States of America June 2006

The following are trademarks of International Business Machines Corporation in the United States, or other countries, or both.

IBM PowerPC

IBM Logo PowerPC Architecture

Other company, product, and service names may be trademarks or service marks of others. All information contained in this document is subject to change without notice. The products described in this document are NOT intended for use in applications such as implantation, life support, or other hazardous uses where malfunction could result in death, bodily injury, or catastrophic property damage. The information contained in this document does not affect or change IBM product specifications or warranties. Nothing in this document shall operate as an express or implied license or indemnity under the intellectual property rights of IBM or third parties. All information contained in this document was obtained in specific environments, and is presented as an illustration. The results obtained in other operating environments may vary.

THE INFORMATION CONTAINED IN THIS DOCUMENT IS PROVIDED ON AN "AS IS" BASIS. In no event will IBM be liable for damages arising directly or indirectly from any use of the information contained in this document.

IBM Systems and Technology Group  
2070 Route 52, Bldg. 330  
Hopewell Junction, NY 12533-6351

The IBM home page can be found at [ibm.com](http://ibm.com)

The IBM semiconductor solutions home page can be found at [ibm.com/chips](http://ibm.com/chips)

June 15, 2006

# Contents

<b>1</b>	<b>Overview</b>	<b>1</b>
1.1	Terminology . . . . .	1
1.2	Usage Scenarios . . . . .	1
<b>2</b>	<b>Data Structure Documentation</b>	<b>9</b>
2.1	spe_context Struct Reference . . . . .	9
2.2	spe_event_data Union Reference . . . . .	9
2.3	spe_event_unit Struct Reference . . . . .	10
2.4	spe_gang_context Struct Reference . . . . .	10
2.5	spe_program_handle Struct Reference . . . . .	10
2.6	spe_stop_info Struct Reference . . . . .	11
<b>3</b>	<b>File Documentation</b>	<b>13</b>
3.1	design.txt File Reference . . . . .	13
3.2	libspe2-types.h File Reference . . . . .	13
3.3	libspe2.h File Reference . . . . .	17
	<b>Index</b>	<b>21</b>



# 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 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:

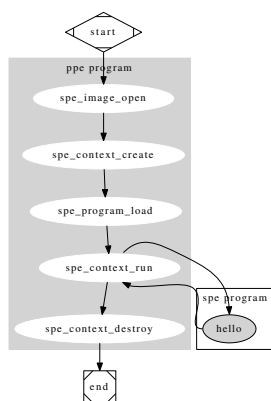


Figure 1.1: Simple program

```

#include <stdlib.h>
#include "libspe2.h"

int main()
{
    spe_context_ptr_t ctx;
    unsigned int flags = 0;
    unsigned int entry = SPE_DEFAULT_ENTRY;
    void * argp = NULL;
    void * envp = NULL;
    spe_program_handle_t * program;

    program = spe_image_open("hello");

    ctx = spe_context_create(flags, 0);
    spe_program_load(ctx, program);
    spe_context_run(ctx, &entry, flags, argp, envp, NULL);
    spe_context_destroy(ctx);
}

```

Here is the same sample with some error checking:

```

#include <errno.h>
#include <stdio.h>
#include <stdlib.h>
#include "libspe2.h"

int main(void)
{
    spe_context_ptr_t ctx;
    int flags = 0;
    unsigned int entry = SPE_DEFAULT_ENTRY;
    void * argp = NULL;
    void * envp = NULL;
    spe_program_handle_t * program;
    spe_stop_info_t stop_info;
    int rc;

    program = spe_image_open("hello");
    if (!program) {
        perror("spe_open_image");
        return -1;
    }
}

```

```

    }

    ctx = spe_context_create(flags, NULL);
    if (ctx == NULL) {
        perror("spe_context_create");
        return -2;
    }
    if (spe_program_load(ctx, program)) {
        perror("spe_program_load");
        return -3;
    }
    rc = spe_context_run(ctx, &entry, 0, argp, envp, &stop_info);
    if (rc < 0)
        perror("spe_context_run");

    spe_context_destroy(ctx);

    return 0;
}

```

### 1.2.2 Multi-threaded sample

This illustrates a threaded sample using the pthread library:

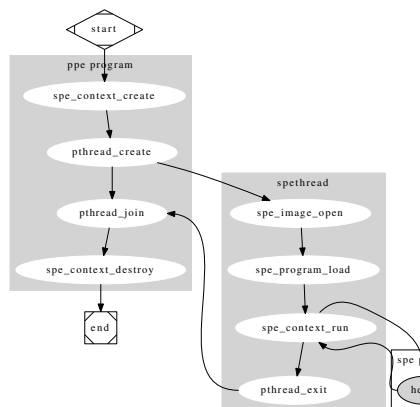


Figure 1.2: Simple pthread program

```

#include <stdlib.h>
#include <pthread.h>
#include "libspe2.h"

struct thread_args {
    struct spe_context * ctx;
    void * argp;
    void * envp;
};

void * spe_thread(void * arg)
{
    int flags = 0;
    unsigned int entry = SPE_DEFAULT_ENTRY;
    spe_program_handle_t * program;
    struct thread_args * arg_ptr;

```

```

    arg_ptr = (struct thread_args *) arg;

    program = spe_image_open("hello");
    spe_program_load(arg_ptr->ctx, program);
    spe_context_run(arg_ptr->ctx, &entry, flags, arg_ptr->argp, arg_ptr->envp, NULL);
    pthread_exit(NULL);
}

int main() {
    int thread_id;
    pthread_t pts;
    spe_context_ptr_t ctx;
    struct thread_args t_args;
    int value = 1;

    ctx = spe_context_create(0, NULL);

    t_args.ctx = ctx;
    t_args.argp = &value;

    thread_id = pthread_create(&pts, NULL, &spe_thread, &t_args);

    pthread_join(pts, NULL);
    spe_context_destroy(ctx);

    return 0;
}

```

Here is the same sample with some error checking:

```

#include <errno.h>
#include <stdio.h>
#include <stdlib.h>
#include <pthread.h>
#include "libspe2.h"

struct thread_args {
    struct spe_context * ctx;
    void * argp;
    void * envp;
};

void * spe_thread(void * arg);

__attribute__((noreturn)) void * spe_thread(void * arg)
{
    int flags = 0;
    unsigned int entry = SPE_DEFAULT_ENTRY;
    int rc;
    spe_program_handle_t * program;
    struct thread_args * arg_ptr;

    arg_ptr = (struct thread_args *) arg;

    program = spe_image_open("hello");
    if (!program) {
        perror("spe_image_open");
        pthread_exit(NULL);
    }

    if (spe_program_load(arg_ptr->ctx, program)) {
        perror("spe_program_load");
        pthread_exit(NULL);
    }

    rc = spe_context_run(arg_ptr->ctx, &entry, flags, arg_ptr->argp, arg_ptr->envp, NULL);
    if (rc < 0)
        perror("spe_context_run");

    pthread_exit(NULL);
}

int main() {
    int thread_id;
    pthread_t pts;
    spe_context_ptr_t ctx;

```



```

    struct thread_args t_args;
    int value = 1;
    int flags = 0;

    if (!(ctx = spe_context_create(flags, NULL))) {
        perror("spe_create_context");
        return -2;
    }

    t_args.ctx = ctx;
    t_args.argp = &value;

    thread_id = pthread_create(&pts, NULL, &spe_thread, &t_args);

    pthread_join(pts, NULL);
    spe_context_destroy(ctx);

    return 0;
}

```

### 1.2.3 Problem state mapping samples

This illustrates accessing the MFC Local Store Address Register.

```

#include <stdio.h>
#include <stdlib.h>
#include "libspe2.h"

int main(void)
{
    spe_context_ptr_t ctx;
    int flags = SPE_MAP_PS;
    struct spe_mfc_command_area * mfc_cmd_area;
    struct spe_spu_control_area * spu_control_area;
    unsigned int MFC_LSA;
    unsigned int status;

    printf("starting ..\n");
    ctx = spe_context_create(flags, NULL);
    mfc_cmd_area = spe_ps_area_get(ctx, SPE_MFC_COMMAND_AREA);
    printf("mfc_cmd_area is: %p\n", mfc_cmd_area);
    MFC_LSA = mfc_cmd_area->MFC_LSA;
    spu_control_area = spe_ps_area_get(ctx, SPE_CONTROL_AREA);
    status = spu_control_area->SPU_Status;
    spe_context_destroy(ctx);
    printf("%d done\n", status);
    printf("%d done\n", MFC_LSA);
}

```

### 1.2.4 Event samples

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

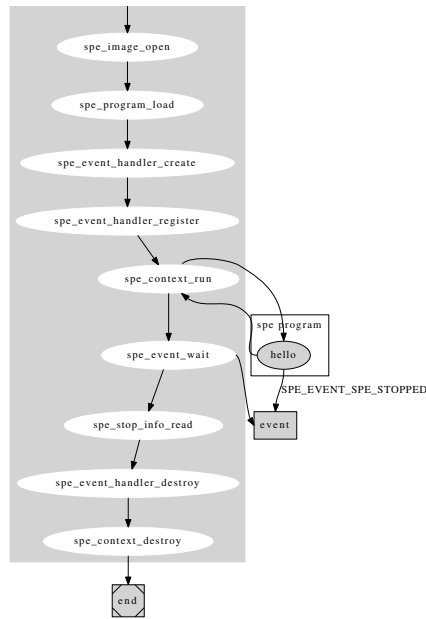


Figure 1.3: Simple event program

```

#include <libspe2.h>

#define MAX_EVENTS 8
#define SIZE 8
#define COUNT 1

int main()
{
    int i, rc, event.count;
    spe_event_handler_ptr_t evhandler;
    spe_event_unit_t event;
    spe_context_ptr_t ctx;
    spe_event_unit_t events[MAX_EVENTS];
    spe_stop_info_t stop.info;
    spe_program_handle_t * program;
    unsigned int entry = SPE_DEFAULT_ENTRY;
    void * argp = NULL;
    void * envp = NULL;

    /* Create a context. */
    ctx = spe_context_create(SPE_EVENTS_ENABLE, NULL);
    if (ctx == NULL) {
        perror("spe_context_create");
        return -2;
    }

    /* load the program. */
    program = spe_image_open("hello");
    if (!program) {
        perror("spe_open_image");
        return -1;
    }

    if (spe_program_load(ctx, program)) {
        perror("spe_program_load");
        return -3;
    }

    /* Create a handle. */
    evhandler = spe_event_handler_create();

    /* Register events. */
    event.events = SPE_EVENT_SPE_STOPPED;
    event.spe = ctx;

```

```

    rc = spe_event_handler_register(evhandler, &event);

    /* run the context */
    rc = spe_context_run(ctx, &entry, 0, argp, envp, &stop_info);
    if (rc < 0)
        perror("spe_context_run");

    /* Get events. */
    event_count = spe_event_wait(evhandler, events, MAX_EVENTS, 0);
    printf("event_count: %d\n", event_count);

    /* Handle events. */
    for (i = 0; i < event_count; i++) {
        printf("event %d: %d\n", i, events[i].events);
        if (events[i].events & SPE_EVENT_SPE_STOPPED) {
            printf("received SPE_EVENT_SPE_STOPPED\n");
            rc = spe_stop_info_read(events[i].spe, &stop_info);
            printf("exit_code: %d\n", stop_info.result.
spe_exit_code);
        }
    }

    /* Destroy the handle. */
    spe_event_handler_destroy(evhandler);

    /* Destroy the context. */
    spe_context_destroy(ctx);

    return 0;
}

```

Events are more useful in multithreaded environments:

```

#include <errno.h>
#include <stdio.h>
#include <stdlib.h>
#include <pthread.h>
#include "libspe2.h"

#define MAX_EVENTS 8
#define SIZE 8
#define COUNT 1

struct thread_args {
    struct spe_context * ctx;
    void * argp;
    void * envp;
};

void * spe_thread(void * arg);

__attribute__((noreturn)) void * spe_thread(void * arg)
{
    int flags = 0;
    unsigned int entry = SPE_DEFAULT_ENTRY;
    int rc;
    spe_program_handle_t * program;
    struct thread_args * arg_ptr;

    arg_ptr = (struct thread_args *) arg;

    program = spe_image_open("hellointr");
    if (!program) {
        perror("spe_image_open");
        pthread_exit(NULL);
    }

    if (spe_program_load(arg_ptr->ctx, program)) {
        perror("spe_program_load");
        pthread_exit(NULL);
    }

    rc = spe_context_run(arg_ptr->ctx, &entry, flags, arg_ptr->argp, arg_ptr->envp, NULL);
    if (rc < 0)
        perror("spe_context_run");
}

```

```

        pthread_exit(NULL);
    }

    int main() {
        int thread_id;
        int i, rc, event_count;
        pthread_t pts;
        spe_context_ptr_t ctx;
        struct thread_args t_args;
        int value = 1;
        int flags = SPE_EVENTS_ENABLE;
        spe_event_handler_ptr_t evhandler;
        spe_event_unit_t event;
        spe_event_unit_t events[MAX_EVENTS];
        unsigned int mbox.data[COUNT];
        spe_stop_info_t stop_info;
        int cont;

        if (!(ctx = spe_context_create(flags, NULL))) {
            perror("spe_create_context");
            return -2;
        }

        /* Create a handle. */
        evhandler = spe_event_handler_create();

        /* Register events. */
        event.events = SPE_EVENT_OUT_INTR_MBOX |
        SPE_EVENT_SPE_STOPPED;
        event.spe = ctx;
        rc = spe_event_handler_register(evhandler, &event);

        /* start pthread */
        t_args.ctx = ctx;
        t_args.argp = &value;

        thread_id = pthread_create(&pts, NULL, &spe_thread, &t_args);

        /* Get events. */
        cont = 1;
        while (cont) {
            event_count = spe_event_wait(evhandler, events, MAX_EVENTS, -1);
            printf("event_count %d\n", event_count);

            /* Handle events. */
            for (i = 0; i < event_count; i++) {
                printf("event %d: %d\n", i, events[i].events);
                if (events[i].events & SPE_EVENT_OUT_INTR_MBOX) {
                    printf("SPE_EVENT_OUT_INTR_MBOX\n");
                    rc = spe_out_intr_mbox_read(events[i].spe,
                                                mbox.data,
                                                COUNT,
                                                SPE_MBOX_ANY_BLOCKING);
                }
                if (events[i].events & SPE_EVENT_SPE_STOPPED) {
                    printf("SPE_EVENT_SPE_STOPPED\n");
                    rc = spe_stop_info_read(events[i].spe, &stop_info);
                    printf("stop.reason: %d\n", stop_info.
stop_reason);
                }
                cont = 0;
            }
        }

        pthread_join(pts, NULL);

        /* Destroy the handle. */
        spe_event_handler_destroy(evhandler);

        /* Destroy the context. */
        spe_context_destroy(ctx);

        return 0;
    }

```

## Chapter 2

# Data Structure Documentation

### 2.1 spe\_context Struct Reference

#### Data Fields

- [spe\\_program\\_handle\\_t](#) handle
- struct spe\_context\_base\_priv \* [base\\_private](#)
- struct spe\_context\_event\_priv \* [event\\_private](#)

#### 2.1.1 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.

#### 2.1.2 Field Documentation

`struct spe_context_base_priv* base_private`

`struct spe_context_event_priv* event_private`

`spe_program_handle_t handle`

### 2.2 spe\_event\_data Union Reference

#### Data Fields

- void \* [ptr](#)
- unsigned int [u32](#)
- unsigned long long [u64](#)

#### 2.2.1 Detailed Description

`spe_event_data_t` User data to be associated with an event

### 2.2.2 Field Documentation

`void* ptr`

`unsigned int u32`

`unsigned long long u64`

## 2.3 `spe_event_unit` Struct Reference

### Data Fields

- unsigned int [events](#)
- [spe\\_context\\_ptr\\_t](#) `spe`
- [spe\\_event\\_data\\_t](#) `data`

### 2.3.1 Detailed Description

`spe_event_t`

### 2.3.2 Field Documentation

`spe_event_data_t data`

`unsigned int events`

`spe_context_ptr_t spe`

## 2.4 `spe_gang_context` Struct Reference

### Data Fields

- struct `spe_gang_context_base_priv` \* [base\\_private](#)
- struct `spe_gang_context_event_priv` \* [event\\_private](#)

### 2.4.1 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.

### 2.4.2 Field Documentation

`struct spe_gang_context_base_priv* base_private`

`struct spe_gang_context_event_priv* event_private`

## 2.5 `spe_program_handle` Struct Reference

### Data Fields

- unsigned int [handle\\_size](#)
- void \* [elf\\_image](#)
- void \* [toe\\_shadow](#)

### 2.5.1 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.

### 2.5.2 Field Documentation

**void\* elf\_image**

**unsigned int handle\_size**

**void\* toe\_shadow**

## 2.6 spe\_stop\_info Struct Reference

### 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](#)
- int [spe\\_status](#)

### 2.6.1 Detailed Description

`spe_stop_info_t`

### 2.6.2 Field Documentation

**void\* \_\_reserved\_ptr**  
**unsigned long long \_\_reserved\_u64**  
**union { ... } result**  
**int spe\_callback\_error**  
**int spe\_exit\_code**  
**int spe\_isolation\_error**  
**int spe\_runtime\_error**  
**int spe\_runtime\_exception**  
**int spe\_runtime\_fatal**  
**int spe\_signal\_code**  
**int spu\_status**  
**unsigned int stop\_reason**



# Chapter 3

## File Documentation

### 3.1 design.txt File Reference

### 3.2 libspe2-types.h File Reference

#### 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` }

### 3.2.1 Macro Definition Documentation

**#define SIGSPE SIGURG**

SIGSPE maps to SIGURG

```
#define SPE_AFFINITY_MEMORY 0x00002000
```

```
#define SPE_CALLBACK_ERROR 6
```

```
#define SPE_CALLBACK_NEW 1
```

```
#define SPE_CALLBACK_UPDATE 2
```

```
#define SPE_CFG_SIGNOTIFY1_OR 0x00000010
```

Flags for `spe_context_create`

```
#define SPE_CFG_SIGNOTIFY2_OR 0x00000020
```

```
#define SPE_COUNT_PHYSICAL_CPU_NODES 1
```

```
#define SPE_COUNT_PHYSICAL_SPES 2
```

```
#define SPE_COUNT_USABLE_SPES 3
```

```
#define SPE_DEFAULT_ENTRY_UINT_MAX
```

Flags for `_base_spe_context_run`

```
#define SPE_DMA_ALIGNMENT 0x0008
```

Runtime exceptions

```
#define SPE_DMA_SEGMENTATION 0x0020
```

```
#define SPE_DMA_STORAGE 0x0040
```

```
#define SPE_EVENT_ALL_EVENTS
```

**Value:**

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

```
#define SPE_EVENT_IN_MBOX 0x00000002
```

```
#define SPE_EVENT_OUT_INTR_MBOX 0x00000001
```

Supported SPE events

```
#define SPE_EVENT_SPE_STOPPED 0x00000008
```

```
#define SPE_EVENT_TAG_GROUP 0x00000004
```

```
#define SPE_EVENTS_ENABLE 0x00001000
```

```
#define SPE_EXIT 1
```

Symbolic constants for stop reasons as returned in `spe_stop_info.t`

```
#define SPE_INVALID_DMA 0x0800
```

```
#define SPE_ISOLATE 0x00000080
```

```
#define SPE_ISOLATE_EMULATE 0x00000100
```

```
#define SPE_ISOLATION_ERROR 7
```

```
#define SPE_MAP_PS 0x00000040
```

```
#define SPE_MBOX_ALL_BLOCKING 1
```

Behavior flags for mailbox read/write functions

```
#define SPE_MBOX_ANY_BLOCKING 2
```

```
#define SPE_MBOX_ANY_NONBLOCKING 3
```

```
#define SPE_NO_CALLBACKS 0x00000002
```

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

```
#define SPE_RUNTIME_ERROR 3
```

```
#define SPE_RUNTIME_EXCEPTION 4
```

```
#define SPE_RUNTIME_FATAL 5
```

```
#define SPE_SIG_NOTIFY_REG_1 0x0001
```

Signal Targets

```
#define SPE_SIG_NOTIFY_REG_2 0x0002
```

```
#define SPE_SPU_HALT 0x04
```

```
#define SPE_SPU_INVALID_CHANNEL 0x40
```

```
#define SPE_SPU_INVALID_INSTR 0x20
```

```
#define SPE_SPU_SINGLE_STEP 0x10
```

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

Runtime errors

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

```
#define SPE_STOP_AND_SIGNAL 2
```

```
#define SPE_TAG_ALL 1
```

Behavior flags tag status functions

```
#define SPE_TAG_ANY 2
```

```
#define SPE_TAG_IMMEDIATE 3
```

### 3.2.2 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)

**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**

**typedef int spe\_event\_handler\_t**

**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)

**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

### 3.2.3 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*

## 3.3 libspe2.h File Reference

### 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)`



### 3.3.1 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 )

```



# Index

- `__reserved_ptr`
    - `spe_stop_info`, [12](#)
  - `__reserved_u64`
    - `spe_stop_info`, [12](#)
- `base_private`
  - `spe_context`, [9](#)
  - `spe_gang_context`, [10](#)
- `data`
  - `spe_event_unit`, [10](#)
- `design.txt`, [13](#)
- `elf_image`
  - `spe_program_handle`, [11](#)
- `event_private`
  - `spe_context`, [9](#)
  - `spe_gang_context`, [10](#)
- `events`
  - `spe_event_unit`, [10](#)
- `handle`
  - `spe_context`, [9](#)
- `handle_size`
  - `spe_program_handle`, [11](#)
- `libspe2-types.h`
  - `SPE_CONTROL_AREA`, [17](#)
  - `SPE_MFC_COMMAND_AREA`, [17](#)
  - `SPE_MSSYNC_AREA`, [17](#)
  - `SPE_SIG_NOTIFY_1_AREA`, [17](#)
  - `SPE_SIG_NOTIFY_2_AREA`, [17](#)
- `libspe2-types.h`, [13](#)
  - `ps_area`, [17](#)
  - `SIGSPE`, [14](#)
  - `SPE_AFFINITY_MEMORY`, [14](#)
  - `SPE_CALLBACK_ERROR`, [15](#)
  - `SPE_CALLBACK_NEW`, [15](#)
  - `SPE_CALLBACK_UPDATE`, [15](#)
  - `SPE_DEFAULT_ENTRY`, [15](#)
  - `SPE_DMA_ALIGNMENT`, [15](#)
  - `SPE_DMA_STORAGE`, [15](#)
  - `SPE_EVENT_IN_MBOX`, [15](#)
  - `SPE_EVENTS_ENABLE`, [15](#)
  - `SPE_EXIT`, [15](#)
  - `SPE_INVALID_DMA`, [15](#)
  - `SPE_ISOLATE`, [16](#)
  - `SPE_ISOLATE_EMULATE`, [16](#)
  - `SPE_ISOLATION_ERROR`, [16](#)
  - `SPE_MAP_PS`, [16](#)
  - `SPE_NO_CALLBACKS`, [16](#)
  - `SPE_RUN_USER_REGS`, [16](#)
  - `SPE_RUNTIME_ERROR`, [16](#)
  - `SPE_RUNTIME_FATAL`, [16](#)
  - `SPE_SPU_HALT`, [16](#)
  - `SPE_TAG_ALL`, [16](#)
  - `SPE_TAG_ANY`, [16](#)
  - `SPE_TAG_IMMEDIATE`, [16](#)
  - `spe_context_ptr_t`, [16](#)
  - `spe_event_data_t`, [16](#)
  - `spe_event_handler_ptr_t`, [17](#)
  - `spe_event_handler_t`, [17](#)
  - `spe_event_unit_t`, [17](#)
  - `spe_gang_context_ptr_t`, [17](#)
  - `spe_program_handle_t`, [17](#)
  - `spe_stop_info_t`, [17](#)
- `libspe2.h`, [17](#)
  - `spe_callback_handler_deregister`, [20](#)
  - `spe_callback_handler_query`, [20](#)
  - `spe_callback_handler_register`, [20](#)
  - `spe_context_create`, [20](#)
  - `spe_context_create_affinity`, [20](#)
  - `spe_context_destroy`, [20](#)
  - `spe_context_run`, [20](#)
  - `spe_cpu_info_get`, [20](#)
  - `spe_event_handler_create`, [20](#)
  - `spe_event_handler_deregister`, [20](#)
  - `spe_event_handler_destroy`, [20](#)
  - `spe_event_handler_register`, [20](#)
  - `spe_event_wait`, [20](#)
  - `spe_gang_context_create`, [20](#)
  - `spe_gang_context_destroy`, [20](#)
  - `spe_image_close`, [20](#)
  - `spe_image_open`, [20](#)
  - `spe_in_mbox_status`, [20](#)
  - `spe_in_mbox_write`, [20](#)
  - `spe_ls_area_get`, [20](#)
  - `spe_ls_size_get`, [20](#)
  - `spe_mfcio_get`, [20](#)
  - `spe_mfcio_getb`, [20](#)
  - `spe_mfcio_getf`, [20](#)

- spe\_mfcio\_put, 20
- spe\_mfcio\_putb, 20
- spe\_mfcio\_putf, 20
- spe\_mfcio\_tag\_status\_read, 20
- spe\_mssync\_start, 20
- spe\_mssync\_status, 20
- spe\_out\_intr\_mbox\_read, 20
- spe\_out\_intr\_mbox\_status, 20
- spe\_out\_mbox\_read, 20
- spe\_out\_mbox\_status, 20
- spe\_program\_load, 20
- spe\_ps\_area\_get, 20
- spe\_signal\_write, 20
- spe\_stop\_info\_read, 20
- ps\_area
  - libspe2-types.h, 17
- ptr
  - spe\_event\_data, 10
- result
  - spe\_stop\_info, 12
- SPE\_CONTROL\_AREA
  - libspe2-types.h, 17
- SPE\_MFC\_COMMAND\_AREA
  - libspe2-types.h, 17
- SPE\_MSSYNC\_AREA
  - libspe2-types.h, 17
- SPE\_SIG\_NOTIFY\_1\_AREA
  - libspe2-types.h, 17
- SPE\_SIG\_NOTIFY\_2\_AREA
  - libspe2-types.h, 17
- SIGSPE
  - libspe2-types.h, 14
- SPE\_AFFINITY\_MEMORY
  - libspe2-types.h, 14
- SPE\_CALLBACK\_ERROR
  - libspe2-types.h, 15
- SPE\_CALLBACK\_NEW
  - libspe2-types.h, 15
- SPE\_CALLBACK\_UPDATE
  - libspe2-types.h, 15
- SPE\_DEFAULT\_ENTRY
  - libspe2-types.h, 15
- SPE\_DMA\_ALIGNMENT
  - libspe2-types.h, 15
- SPE\_DMA\_STORAGE
  - libspe2-types.h, 15
- SPE\_EVENT\_IN\_MBOX
  - libspe2-types.h, 15
- SPE\_EVENTS\_ENABLE
  - libspe2-types.h, 15
- SPE\_EXIT
  - libspe2-types.h, 15
- SPE\_INVALID\_DMA
  - libspe2-types.h, 15
- SPE\_ISOLATE
  - libspe2-types.h, 16
- SPE\_ISOLATE\_EMULATE
  - libspe2-types.h, 16
- SPE\_ISOLATION\_ERROR
  - libspe2-types.h, 16
- SPE\_MAP\_PS
  - libspe2-types.h, 16
- SPE\_NO\_CALLBACKS
  - libspe2-types.h, 16
- SPE\_RUN\_USER\_REGS
  - libspe2-types.h, 16
- SPE\_RUNTIME\_ERROR
  - libspe2-types.h, 16
- SPE\_RUNTIME\_FATAL
  - libspe2-types.h, 16
- SPE\_SPU\_HALT
  - libspe2-types.h, 16
- SPE\_TAG\_ALL
  - libspe2-types.h, 16
- SPE\_TAG\_ANY
  - libspe2-types.h, 16
- SPE\_TAG\_IMMEDIATE
  - libspe2-types.h, 16
- spe
  - spe\_event\_unit, 10
  - spe\_callback\_error
    - spe\_stop\_info, 12
  - spe\_callback\_handler\_deregister
    - libspe2.h, 20
  - spe\_callback\_handler\_query
    - libspe2.h, 20
  - spe\_callback\_handler\_register
    - libspe2.h, 20
  - spe\_context, 9
    - base\_private, 9
    - event\_private, 9
    - handle, 9
  - spe\_context\_create
    - libspe2.h, 20
  - spe\_context\_create\_affinity
    - libspe2.h, 20
  - spe\_context\_destroy
    - libspe2.h, 20
  - spe\_context\_ptr\_t
    - libspe2-types.h, 16
  - spe\_context\_run
    - libspe2.h, 20
  - spe\_cpu\_info\_get
    - libspe2.h, 20
  - spe\_event\_data, 9

- ptr, 10
- u32, 10
- u64, 10
- spe\_event\_data\_t
  - libspe2-types.h, 16
- spe\_event\_handler\_create
  - libspe2.h, 20
- spe\_event\_handler\_deregister
  - libspe2.h, 20
- spe\_event\_handler\_destroy
  - libspe2.h, 20
- spe\_event\_handler\_ptr\_t
  - libspe2-types.h, 17
- spe\_event\_handler\_register
  - libspe2.h, 20
- spe\_event\_handler\_t
  - libspe2-types.h, 17
- spe\_event\_unit, 10
  - data, 10
  - events, 10
  - spe, 10
- spe\_event\_unit\_t
  - libspe2-types.h, 17
- spe\_event\_wait
  - libspe2.h, 20
- spe\_exit\_code
  - spe\_stop\_info, 12
- spe\_gang\_context, 10
  - base\_private, 10
  - event\_private, 10
- spe\_gang\_context\_create
  - libspe2.h, 20
- spe\_gang\_context\_destroy
  - libspe2.h, 20
- spe\_gang\_context\_ptr\_t
  - libspe2-types.h, 17
- spe\_image\_close
  - libspe2.h, 20
- spe\_image\_open
  - libspe2.h, 20
- spe\_in\_mbox\_status
  - libspe2.h, 20
- spe\_in\_mbox\_write
  - libspe2.h, 20
- spe\_isolation\_error
  - spe\_stop\_info, 12
- spe\_ls\_area\_get
  - libspe2.h, 20
- spe\_ls\_size\_get
  - libspe2.h, 20
- spe\_mfcio\_get
  - libspe2.h, 20
- spe\_mfcio\_getb
  - libspe2.h, 20
- spe\_mfcio\_getf
  - libspe2.h, 20
- spe\_mfcio\_put
  - libspe2.h, 20
- spe\_mfcio\_putb
  - libspe2.h, 20
- spe\_mfcio\_putf
  - libspe2.h, 20
- spe\_mfcio\_tag\_status\_read
  - libspe2.h, 20
- spe\_mssync\_start
  - libspe2.h, 20
- spe\_mssync\_status
  - libspe2.h, 20
- spe\_out\_intr\_mbox\_read
  - libspe2.h, 20
- spe\_out\_intr\_mbox\_status
  - libspe2.h, 20
- spe\_out\_mbox\_read
  - libspe2.h, 20
- spe\_out\_mbox\_status
  - libspe2.h, 20
- spe\_program\_handle, 10
  - elf\_image, 11
  - handle\_size, 11
  - toe\_shadow, 11
- spe\_program\_handle\_t
  - libspe2-types.h, 17
- spe\_program\_load
  - libspe2.h, 20
- spe\_ps\_area\_get
  - libspe2.h, 20
- spe\_runtime\_error
  - spe\_stop\_info, 12
- spe\_runtime\_exception
  - spe\_stop\_info, 12
- spe\_runtime\_fatal
  - spe\_stop\_info, 12
- spe\_signal\_code
  - spe\_stop\_info, 12
- spe\_signal\_write
  - libspe2.h, 20
- spe\_stop\_info, 11
  - \_\_reserved\_ptr, 12
  - \_\_reserved\_u64, 12
  - result, 12
  - spe\_callback\_error, 12
  - spe\_exit\_code, 12
  - spe\_isolation\_error, 12
  - spe\_runtime\_error, 12
  - spe\_runtime\_exception, 12
  - spe\_runtime\_fatal, 12
  - spe\_signal\_code, 12
  - spu\_status, 12

- stop\_reason, [12](#)
- spe\_stop\_info\_read
  - libspe2.h, [20](#)
- spe\_stop\_info\_t
  - libspe2-types.h, [17](#)
- spu\_status
  - spe\_stop\_info, [12](#)
- stop\_reason
  - spe\_stop\_info, [12](#)
- toe\_shadow
  - spe\_program\_handle, [11](#)
- u32
  - spe\_event\_data, [10](#)
- u64
  - spe\_event\_data, [10](#)