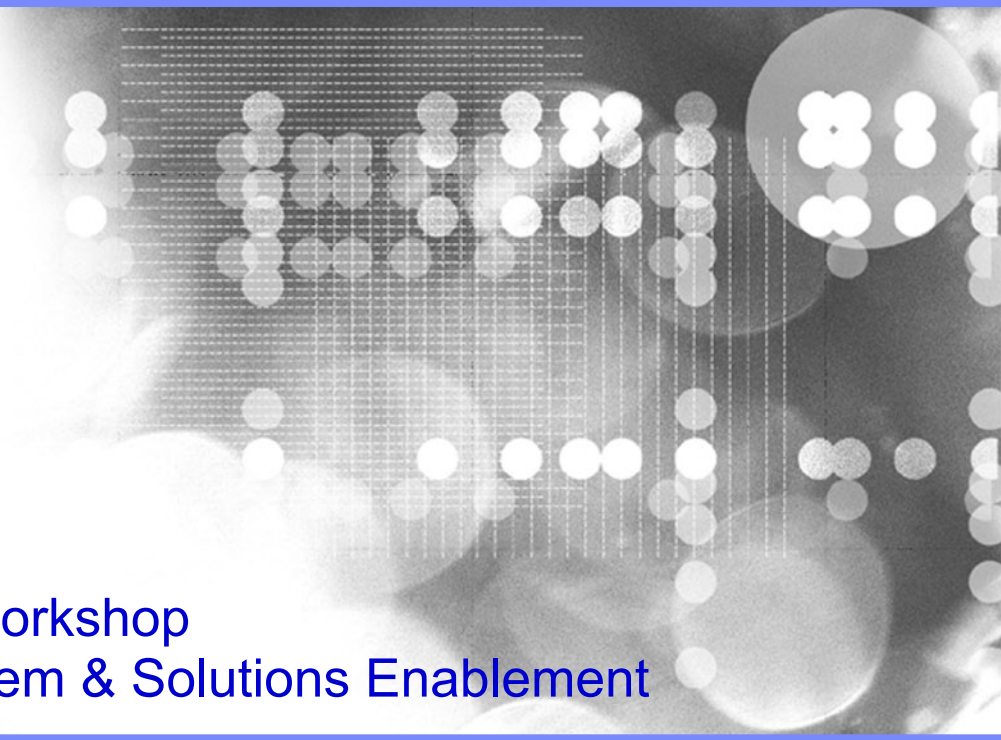
Hands-on DMA 1



Cell Programming Workshop
Cell/Quasar Ecosystem & Solutions Enablement

Class Objectives

- **At the end of this class you should know how to use DMA to transfer data between SPU and PPU, back and forth, using a buffer**

Class agenda

- **DMA transfer into an SPU from a PPU**
- **Example of mfc_get**
- **DMA transfer from an SPU into a PPU**
- **Example of mfc_put**

  – /opt/cell_class/Hands-on-21/basicDMA

DMA data into an SPU - mfc_get

DMA Example: Read into Local Store

```
void dma_mem_to_ls(unsigned int mem_addr,
         volatile void *ls_addr,unsigned int size)
{
  unsigned int tag = 0;
  unsigned int mask = 1;
  mfc_get(ls_addr,mem_addr,size,tag,0,0);
  mfc_write_tag_mask(mask);
  mfc_read_tag_status_all();
}
```

Read contents of mem_addr into ls_addr

Set tag mask

Wait for all tag DMA completed

DMA data out of the SPU into the PPU – mfc_put

DMA Example: Write to Main Memory

```
void dma_ls_to_mem(unsigned int mem_addr,volatile void
*ls_addr, unsigned int size)
{
  unsigned int tag = 0;
  unsigned int mask = 1;
  mfc_put(ls_addr,mem_addr,size,tag,0,0);
  mfc_write_tag_mask(mask);
  mfc_read_tag_status_all();
}
```

Write contents of mem_addr into ls_addr

Set tag mask

Wait for all tag DMA completed

Using libspe 2.x – synchronous thread model

The PPU program

```
#include <stdio.h>
//#include <libspe.h>
//#include <libmisc.h>
#include <string.h>
#include <libspe2.h>

//spu program
extern spe_program_handle_t getbuf_spu;
//local buffer
unsigned char buffer[128] __attribute__
    ((aligned(128)));
//spe context
spe_context_ptr_t speid;
unsigned int flags = 0;
unsigned int entry = SPE_DEFAULT_ENTRY;
spe_stop_info_t stop_info;
int rc;
```

```
int main (void)
{
    strcpy (buffer, "Good morning!");
    printf("Original buffer is %s\n", buffer);
    speid = spe_context_create(flags, NULL);
        spe_program_load(speid, &getbuf_spu);
    rc = spe_context_run(speid, &entry, 0, buffer,
    NULL, &stop_info);
    spe_context_destroy(speid);

    printf("New modified buffer is %s\n", buffer);
    return 0;
}
```

```
DIRS                    = spu
PROGRAM_ppu             = getbuf_dma
IMPORTS  = -lspe2 -lpthread -lmisc \
                        spu/getbuf_spu.a
include $(CELL_TOP)/make.footer
```

The SPU program

```
#include <stdio.h>
#include <string.h>
//#include <libmisc.h>
#include <spu_mfcio.h>
unsigned char buffer[128] __attribute__ ((aligned(128)));
int main(unsigned long long speid, unsigned long long argp, unsigned long long envp)
{
    int tag = 31, tag_mask = 1<<tag;
    // DMA in buffer from PPE
    mfc_get(buffer, (unsigned long long)argp, 128, tag, 0, 0);
    mfc_write_tag_mask(tag_mask);
    mfc_read_tag_status_any();
    printf("SPE received buffer \"%s\"\n", buffer);
    // modify buffer
    strcpy (buffer, "Guten Morgen!");
    printf("SPE sent to PPU buffer \"%s\"\n", buffer);
    // DMA out buffer to PPE
    mfc_put(buffer, (unsigned long long)argp, 128, tag, 0, 0);
    mfc_write_tag_mask(tag_mask);
    mfc_read_tag_status_any();
    return 0;
```

```
PROGRAM_spu      := getbuf_spu
LIBRARY_embed    := getbuf_spu.a
IMPORTS          = -lmisc
include $(CELL_TOP)/make.footer
```

Using libspe 2.x – asynchronous thread model

The PPU program

```
#include <stdio.h>
//#include <libspe.h>
//#include <libmisc.h>
#include <string.h>
#include <libspe2.h>
#include <pthread.h>
typedef struct ppu_pthread_data{
   spe_context_ptr_t context;
   pthread_t pthread;
   unsigned int entry;
   unsigned int flags;
   void *argp;
   void *envp;
   spe_stop_info_t stopinfo;
}  ppu_pthread_data_t;
void *ppu_pthread_function(void *arg)
{
   ppu_pthread_data_t *datap = (ppu_pthread_data_t *)arg;
   int rc;
      rc = spe_context_run(datap->context, &datap->entry, datap-
     >flags, datap->argp, datap->envp, &datap->stopinfo);
   pthread_exit(NULL);
}
//spu program
extern spe_program_handle_t getbuf_spu;
//local buffer
unsigned char buffer[128] __attribute__ ((aligned(128)));
```

```
//spe context
//spe_context_ptr_t speid;
//unsigned int flags = 0;
//unsigned int entry = SPE_DEFAULT_ENTRY;
//spe_stop_info_t stop_info;
//int rc;
int main (void)
{
strcpy (buffer, "Good morning!");
      printf("Original buffer is %s\n", buffer);
//    speid = spe_context_create(flags, NULL);
//    spe_program_load(speid, &getbuf_spu);
//    rc = spe_context_run(speid, &entry, 0, buffer, NULL, &stop_info);
//    spe_context_destroy(speid);
   ppu_pthread_data_t data;
   data.context = spe_context_create(0, NULL);
   spe_program_load(data.context, &getbuf_spu);
   data.entry = SPE_DEFAULT_ENTRY;
   data.flags = 0;
   data.argp = buffer;
   data.envp = NULL;
   pthread_create(&data.pthread, NULL, &ppu_pthread_function, &data);
   pthread_join(data.pthread, NULL);
   spe_context_destroy(data.context);
      printf("New modified buffer is %s\n", buffer);
      return 0;
}
```

```
DIRS                          = spu
PROGRAM_ppu                   = getbuf_dma
IMPORTS       = -lspe2 -lpthread -lmisc  spu/getbuf_spu.a
include $(CELL_TOP)/make.footer
```

The SPU program

```
#include <stdio.h>
#include <string.h>
//#include <libmisc.h>
#include <spu_mfcio.h>

unsigned char buffer[128] __attribute__ ((aligned(128)));

int main(unsigned long long speid, unsigned long long argp, unsigned long long envp)
{
    int tag = 31, tag_mask = 1<<tag;
    // DMA in buffer from PPE
    mfc_get(buffer, (unsigned long long)argp, 128, tag, 0, 0);
    mfc_write_tag_mask(tag_mask);
    mfc_read_tag_status_any();
    printf("SPE received buffer \"%s\"\n", buffer);

    // modify buffer
    strcpy (buffer, "Guten Morgen!");
    printf("SPE sent to PPU buffer \"%s\"\n", buffer);
    // DMA out buffer to PPE
    mfc_put(buffer, (unsigned long long)argp, 128, tag, 0, 0);
    mfc_write_tag_mask(tag_mask);
    mfc_read_tag_status_any();
    return 0;
}
```

```
PROGRAM_spu      := getbuf_spu
LIBRARY_embed    := getbuf_spu.a
IMPORTS          = -lmisc
include $(CELL_TOP)/make.footer
```

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