Austin Brown

CPE 434-01

2/7/2021

Lab 4

The purpose of this lab is to write to programs that share a memory space. This means that we have multiple processes that can communicate with each other. We use the shmget(), shmat(), shmctl(), and shmdt() functions to accomplish this.

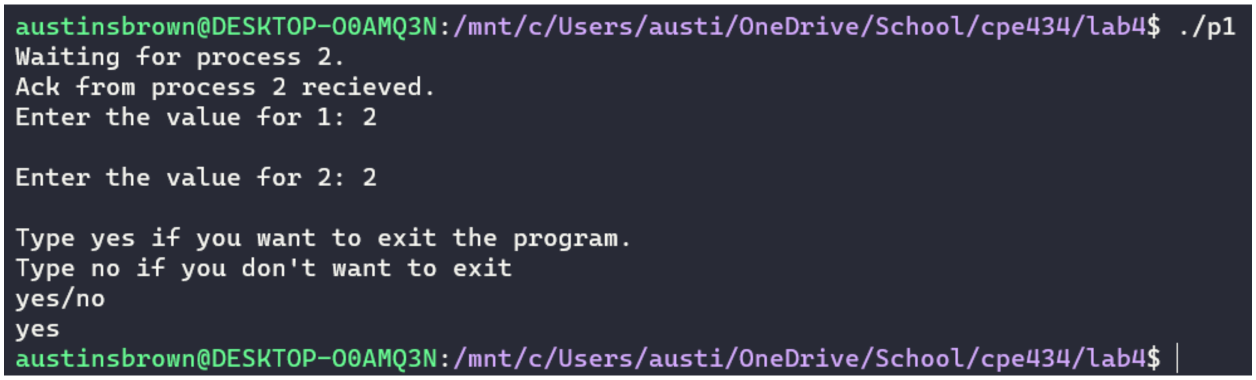
The shmget() function is used to create a shared memory space. We pass in the key of 1234, the size of the space that we want, and a flag. The flag is IPC_CREAT | 0666. This gives the process read write permissions to the space.

The shmat() function attaches the address space of the process to the shared memory space. The first argument to be passed is the identifier of the space. You then pass the attaching address. It is set to 0. The flag is also set to 0.

The shmdt() function detaches a shared memory process. We simply pass the address of the shared space into the function. This function is used in both process 1 and 2.

The shmctl() performs an operation on the shared space. We pass in the identifier first and then the command. We set the buffer argument to null. This destroys the memory segment once the final process is detached from it.

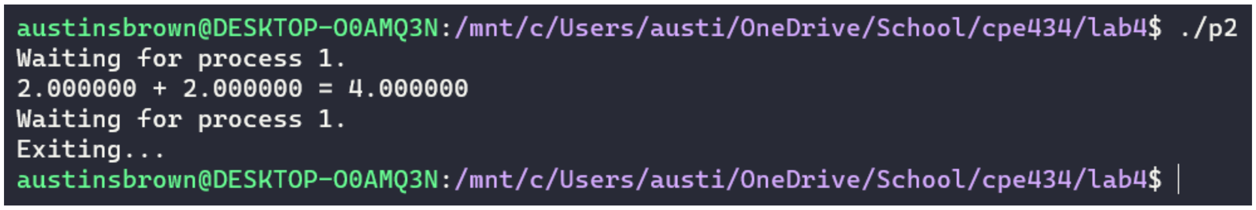
Outputs:



```
austinsbrown@DESKTOP-O0AMQ3N:/mnt/c/Users/austi/OneDrive/School/cpe434/lab4$ ./p1
Waiting for process 2.
Ack from process 2 recieved.
Enter the value for 1: 2

Enter the value for 2: 2

Type yes if you want to exit the program.
Type no if you don't want to exit
yes/no
yes
austinsbrown@DESKTOP-O0AMQ3N:/mnt/c/Users/austi/OneDrive/School/cpe434/lab4$
```



```
austinsbrown@DESKTOP-O0AMQ3N:/mnt/c/Users/austi/OneDrive/School/cpe434/lab4$ ./p2
Waiting for process 1.
2.000000 + 2.000000 = 4.000000
Waiting for process 1.
Exiting...
austinsbrown@DESKTOP-O0AMQ3N:/mnt/c/Users/austi/OneDrive/School/cpe434/lab4$
```

Code:

```c
typedef struct SharedData
{
    float value1, value2;
    float sum;

    /*
        2 if waiting on process 2,
        1 if wating on process 1,
        -1 if done
    */
    int flag;
}SharedData;

#define KEY (key_t)(1244)
#define STRUCTSIZE sizeof(SharedData)
```

```c
#include <stdio.h>
#include <sys/types.h>
#include <string.h>
#include <sys/ipc.h>
#include <sys/shm.h>
#include <stdlib.h>
#include "header.h"

int main()
{
    int identifier; // holds a pid
    int i; // generic counter
    SharedData *control; // info struct
    char buffer[255]; // holds the user input

    strcpy(buffer, "NO");

    /*
       allocates shared mem segment
       key of 1234 is passed in as first arg
```

```
        size of the struct is passed in as second arg
        IPC_CREAT | 0666 sets it to read write
    */
    if((identifier = shmget(KEY, STRUCTSIZE, IPC_CREAT | 0666)) < 0) // check for errors
    {
        printf("An error has occured. Could not create memory segment.\n");
        exit(-1);
    }

    if ((control = (SharedData*) shmat(identifier, 0, 0)) <= (SharedData*)(0))
    {
        printf("Error: Failed to attach address space to shared memory. Terminating...\n");
        exit(1);
    }

    control->flag = 2; // waiting on process 2
    printf("Waiting for process 2.\n");
    while (control->flag == 2);
    printf("Ack from process 2 recieved.\n");

    while(control->flag != -1)
    {
        if(strcasecmp(buffer, "Y") == 0 || strcasecmp(buffer, "YES") == 0) // exit the program?
        {
            control->flag = -1;
        }

        else if(strcasecmp(buffer, "N") == 0 || strcasecmp(buffer, "NO") == 0) // repeat the process
        {
            printf("Enter the value for 1: ");
            scanf("%s", buffer);
            control->value1 = atoi(buffer);
            printf("\nEnter the value for 2: ");
            scanf("%s", buffer);
            control->value2 = atoi(buffer);
            control->flag = 1;
        }

        if(control->flag != -1) // exit the program.
        {
            while(control->flag != 0);
            printf("\nType yes if you want to exit the program.\n");
            printf("Type no if you don't want to exit\n");
            fgets(buffer, 255, stdin);
            buffer[strcspn(buffer, "\n")] = 0;

            while(!(strcasecmp(buffer, "Y") == 0 || strcasecmp(buffer
, "YES") == 0) && !(strcasecmp(buffer, "N") == 0 || strcasecmp(buffer
, "NO") == 0))
            {
                printf("yes/no\n");
                fgets(buffer, 255, stdin);
                buffer[strcspn(buffer, "\n")] = 0;
            }
        }
    }
    shmdt(control); // detach shared memory space
    shmctl(identifier, IPC_RMID, NULL); // mark shared memor space fo
r deletion
    return 0;
}
```

```
#include <stdio.h>
#include <sys/types.h>
#include <string.h>
#include <sys/ipc.h>
#include <sys/shm.h>
#include <stdlib.h>
#include "header.h"
```

```c
int main()
{
    int identifier;
    SharedData *control;

    if((identifier = shmget(KEY, STRUCTSIZE, 0)) < 0) // get the identifier of the space
    {
        printf("Could not find memory segment.\n");
        exit(-1);
    }

    control = (SharedData*)shmat(identifier, 0, 0); // attach the sheared space
    if(control <= (SharedData*)(0))
    {
        printf("Could not attach to shard memory.\n");
        exit(-1);
    }

    control->flag = 2;
    while(control->flag != -1) // do math
    {
        if(control->flag == 1)
        {
            control->sum = control->value1 + control->value2;
            printf("%f + %f = %f\n", control->value1, control->value2, control->sum);
            control->flag = 0;
            printf("Waiting for process 1.\n");
        }

        else if(control->flag == 2)
        {
            printf("Waiting for process 1.\n");
            control->flag = 0;
        }
    }
    printf("Exiting...\n");
    shmdt(control);
}
```

Conclusion:

This lab gave us experience with using shared memory to allow two unrelated process to communicate with each other. This is sort of like piping, but the processes must be related to each other. Shared memory segments allow for more functionality at the cost of more complicated code.