CIS 452

Lab 5 Report

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Shared Memory

## Question One

**What exactly is being output by Sample Program 1 (i.e. what is the meaning of the output values)?**

OUTPUT:

value a: 0x7f566eeef000 value b: 0x7f566eef0000

Value ‘a’ is the address that the shared memory pointer is pointing to (which is the address of the attached shared memory segment)

Value ‘b’ is the memory address of the attached shared memory segment plus 4096, which was the specified size of the shared memory segment when it was first created with shmget earlier in the program

## Question Two

**Read the man pages; then describe the meaning / purpose of each argument used by the shmget() function call.**

**Key -** The first value of shmget is the key value. The key value is compared to existing values that exist within the kernel for other shared memory segments.

**Size -** Shared memory segment size

**Shmflg -** The shmflg is a combination of operation permissions and control commands. After determining the value for  the operation permissions, the desired flags can be specified. if the shflag specifies both IPC\_CREAT and IPC\_EXCL and a shared segment already exists for the key then shmget will fail with errno set to 0\_EXCL

## Question Three

**Describe two specific uses of the shmctl() function call**

Shmctl() is used for many purposes relating to controlling the resource that the kernel created. One use for shmctl() is that it can be used to mark the segment to be destroyed, after the last process detaches it, which is specified by using IPC\_RMID for the cmd argument in the function call. Shmctl() can also be used to prevent swapping of the shared memory segment by locking it down, which is specified by using SHM\_LOCK for the cmd argument in the function call. Similarly, you can also unlock the segment and allow it to again be swapped out by using SHM\_UNLOCK cmd**.**

Useful System Utilities

## Question Four

**Read the man pages, then use shmctl() to modify Sample Program 1 so that it prints out the size of the shared memory segment.**

SOURCE CODE FOR REVISED SAMPLEPROGRAM1.C:

#include <stdio.h>

#include <stdlib.h>

#include <sys/types.h>

#include <sys/stat.h>

#include <sys/ipc.h>

#include <sys/shm.h>

#include <signal.h>

#include <unistd.h>

#define FOO 4096

void sigHandler(int sigNum);

int main ()

{

int shmId;

char \*shmPtr;

struct shmid\_ds sharedMem;

if ((shmId = shmget (IPC\_PRIVATE, FOO, IPC\_CREAT|S\_IRUSR|S\_IWUSR)) < 0) {

perror ("i can't get no..\n");

exit (1);

}

shmctl(shmId,IPC\_STAT, &sharedMem);

printf("The size of the shared memory segment is %lu\n ",sharedMem.shm\_segsz);

if ((shmPtr = shmat (shmId, 0, 0)) == (void\*) -1) {

perror ("can't attach\n");

exit (1);

}

//modify the print statement in Sample Program 1 to determine the ID of the shared memory segment

printf ("shared memory Id is %d\n", shmId);

printf ("value a: %p\t value b: %p\n", (void \*) shmPtr, (void \*) shmPtr + FOO);

pause();

if (shmdt (shmPtr) < 0) {

perror ("just can't let go\n");

exit (1);

}

if (shmctl (shmId, IPC\_RMID, 0) < 0) {

perror ("can't deallocate\n");

exit(1);

}

return 0;

}

void sigHandler(int sigNum){

printf("Exiting good by");

}

## Question Five

**Submit your script (Take a screenshot of commands).**

# Lab Programming Assignment (Readers and Writer)

## Source Code

WRITER PROGRAM CODE:

#include <iostream>

#include <thread>

#include <pthread.h>

#include <string>

#include <stdlib.h>

#include <sys/ipc.h>

#include <sys/shm.h>

#include <stdio.h>

#include <errno.h>

#include<unistd.h>

#include <signal.h>

#include "DataSet.h"

#include <iostream>

#include <cstring>

#include <unistd.h>

#include <unistd.h>

using namespace std;

const int shared\_segment\_size = sizeof(Dataset);

void my\_handler(int num);

Dataset \* shmptr;

int main(){

Dataset \* sharedMemory;

int shmid;

key\_t key;

//set up sigHandler to receive ^C signal and call custom signal handler function

struct sigaction sigIntHandler;

sigIntHandler.sa\_handler = my\_handler;

sigemptyset(&sigIntHandler.sa\_mask);

sigIntHandler.sa\_flags = 0;

sigaction(SIGINT, &sigIntHandler, NULL);

// ftok to generate unique key

if((key=ftok("./",1))<1){

perror("Failed to assign shmid");

exit(1);

}

// shmget returns an identifier in shmid

shmid = shmget(key,shared\_segment\_size,IPC\_CREAT | 0600);

if(shmid < 1){

perror("Failed to assign shmid");

}

//Attach struct to shared memory

sharedMemory = (Dataset\* ) shmat (shmid,NULL, 0);

// sets sharedMemorys values

sharedMemory->shmid=shmid;

sharedMemory->writerTurn=true;

sharedMemory->n=0;

sharedMemory-> numTimesRead=0;

memset(sharedMemory->userInput, '\000', sizeof(sharedMemory->userInput));

shmptr=sharedMemory;

if(sharedMemory==(Dataset\*)-1){

perror("shmat failed ");

exit(1);

}

// shmat to attach to shared memory

//char \*str = (char\*) shmat(shmid,(void\*)0,0);

cout<< "printing the shmid:"<<shmid << "\n";

while(1) {

if(sharedMemory->writerTurn) {

cout << "Please provide data to be written into shared memory: ";

cin >> sharedMemory->userInput;

printf("Data written into memory: %s\n",sharedMemory->userInput);

sharedMemory->writerTurn = 0;

}

}

}

//When user enters ^C, print final stats before exiting the program

void my\_handler(int shmid) {

shmid=shmptr->shmid;

//detach from shared memory

if(shmdt(shmptr)==-1){

perror("failed to detach");

}

if(shmctl(shmid,IPC\_RMID,NULL)==-1){

perror("failed to remove shared memory");

}

cout<< "exiting writer ";

exit(0);

}

READER PROGRAM CODE:

#include<iostream>

#include<thread>

#include <pthread.h>

#include <string>

#include <stdlib.h>

#include <sys/ipc.h>

#include <sys/shm.h>

#include <stdio.h>

#include <errno.h>

#include<unistd.h>

#include <signal.h>

#include <sys/stat.h>

#include "DataSet.h"

using namespace std;

const int shared\_segment\_size = sizeof(Dataset);

void my\_handler(int shmid);

Dataset\* shmptr;

int main(){

Dataset\* sharedMemory;

//Dataset\* sharedMemory = &sharedMem;

int shmid;

key\_t key;

//set up sigHandler to receive ^C signal and call custom signal handler function

//Fancy Singal handler

struct sigaction sigIntHandler;

sigIntHandler.sa\_handler = my\_handler;

/\*

\* The sigemptyset() function is part of a family of functions that manipulate signal sets. Signal sets are data objects that let

\* a thread keep track of groups of signals. For example, a thread might create a signal set to record which signals it is

\* blocking, and another signal set to record which signals are pending. \*/

sigemptyset(&sigIntHandler.sa\_mask);

sigIntHandler.sa\_flags = 0;

sigaction(SIGINT, &sigIntHandler,NULL);

// ftok to generate unique key

signal(SIGSEGV,my\_handler);

if((key = ftok(".",1))<1){

perror("IPC error: ftok");

exit(1);

}

// shmget returns an identifier in shmid

shmid = shmget(key,shared\_segment\_size, S\_IRUSR|S\_IWUSR);

if(shmid < 1){

perror("Failed to assign shmid");

exit(1);

}

cout<< "printing the shmid:"<<shmid << "\n";

//Attach struct to shared memory

sharedMemory = (Dataset\*) shmat(shmid, NULL, 0);

shmptr=sharedMemory;

if(sharedMemory->n==0)

sharedMemory->writerTurn=0;

bool myTurn = true;

sharedMemory->n++;

while(1) {

// last one out shut the lights. This check for the last one out

if(sharedMemory->n ==sharedMemory->numTimesRead){

sharedMemory->numTimesRead = 0;

sharedMemory->writerTurn = 1;}

//provents a process from entering the critical section once it has entered once

if(sharedMemory->writerTurn==1){

myTurn = true;}

// only print out onces

if(sharedMemory->writerTurn==0 && myTurn) {

cout<<sharedMemory->numTimesRead;

myTurn=false;

sharedMemory->numTimesRead = sharedMemory->numTimesRead + 1;

printf("Other side: %s\n", sharedMemory->userInput);

}

}

}

//When user enters ^C, print final stats before exiting the program

void my\_handler(int shmid) {

cout<<"Exsiting reader";

//notify everyone your leaving

shmptr->n--;

shmid=shmptr->shmid;

//detach from shared memory

shmdt(shmptr);

// destroy the shared memory

exit(0);

}

## Sample Output