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CS333 – Fall 2014

Proj 5 – Kernel.c

######################################################################

code Kernel

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-- CS333 Proj 5

-- Due: 11/4/2014

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-- ############ NEW code ############

----------------------------- InitFirstProcess --------------------------

function InitFirstProcess()

var

ptrThread: ptr to Thread

ptrThread = threadManager.GetANewThread()

ptrThread.Init("UserProgramThread")

ptrThread.Fork(StartUserProcess,0)

endFunction

-- ############ NEW code ############

-- ############ NEW code ############

----------------------------- StartUserProcess --------------------------

function StartUserProcess(arg : int)

-- We need to allocate a new PCB and connect it with the current thread.

-- We then initialize the thread field in the PCB and the myProcess

-- field in the current thread. We then open the executable file (hard code).

-- We then create the Logicaladdress space and read the executable into it.

-- We need to remember to close the executable file we opened earlier.

-- Then we need to compute the inital value for the user-level stack.

-- Finially we jump into the user-level program.

var

ptrOpenFile: ptr to OpenFile

ptrToPCB: ptr to ProcessControlBlock

ptrInitSystemStackTop: ptr to int

initPC: int

initUserStackTop: int

previousStatus: int

--Allocate a new PCB and connect it with the current thread

ptrToPCB = processManager.GetANewProcess()

ptrToPCB.myThread = currentThread

currentThread.myProcess = ptrToPCB

-- Open the executable (hard coded)

ptrOpenFile = fileManager.Open("TestProgram1")

if ptrOpenFile == null

FatalError("ERROR: Cannot open 'TestProgram1'.")

endIf

-- create the LogicalAddress space using 'LoadExecutable'

-- And make sure to close the executable (otherwise a syste

-- recourse will become permanently locked up)

initPC = ptrOpenFile.LoadExecutable(& ptrToPCB.addrSpace)

fileManager.Close(ptrOpenFile)

-- Compute the initial value(# of pages \* Page size) and then jump into the

-- user-level program

initUserStackTop = (ptrToPCB.addrSpace.numberOfPages \* PAGE\_SIZE)

ptrInitSystemStackTop = &currentThread.systemStack[SYSTEM\_STACK\_SIZE-1]

previousStatus = SetInterruptsTo(DISABLED)

ptrToPCB.addrSpace.SetToThisPageTable()

currentThread.isUserThread = true

BecomeUserThread(initUserStackTop, initPC, ptrInitSystemStackTop asInteger)

endFunction

-- ############ NEW code ############

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-- ############ NEW code ############

----------------------------- DiskInterruptHandler --------------------------

function DiskInterruptHandler ()

--

-- This routine is called when a disk interrupt occurs. It will

-- signal the "semToSignalOnCompletion" Semaphore and return to

-- the interrupted thread.

--

-- This is an interrupt handler. As such, interrupts will be DISABLED

-- for the duration of its execution.

--

-- Uncomment this code later...

-- FatalError ("DISK INTERRUPTS NOT EXPECTED IN PROJECT 4")

currentInterruptStatus = DISABLED

-- print ("DiskInterruptHandler invoked!\n")

if diskDriver.semToSignalOnCompletion

diskDriver.semToSignalOnCompletion.Up()

endIf

endFunction

-- ############ NEW code ############

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----------------------------- Handle\_Sys\_Exit ---------------------------------

-- ############ NEW code ############

function Handle\_Sys\_Exit (returnStatus: int)

-- NOT IMPLEMENTED

print("Handle\_sys\_Exit invoked!\n")

print("returnStatus = ")

printInt(returnStatus)

print("\n")

endFunction

-- ############ NEW code ############

----------------------------- Handle\_Sys\_Shutdown ---------------------------------

function Handle\_Sys\_Shutdown ()

-- Mock out a system shutdown by calling a FatalError

FatalError("Syscall 'Shutdown' was invoked by a user thread")

endFunction

----------------------------- Handle\_Sys\_Yield ---------------------------------

-- ############ NEW code ############

function Handle\_Sys\_Yield ()

-- NOT IMPLEMENTED

print("Handle\_Sys\_Yield invoked! \n")

endFunction

-- ############ NEW code ############

----------------------------- Handle\_Sys\_Fork ---------------------------------

-- ############ NEW code ############

function Handle\_Sys\_Fork () returns int

-- NOT IMPLEMENTED

print("Handle\_Sys\_Fork invoked! \n")

return 1000

endFunction

-- ############ NEW code ############

----------------------------- Handle\_Sys\_Join ---------------------------------

-- ############ NEW code ############

function Handle\_Sys\_Join (processID: int) returns int

-- NOT IMPLEMENTED

print("Handle\_Sys\_Join invoked!\n")

print("processID = ")

printInt(processID)

print("\n")

return 2000

endFunction

-- ############ NEW code ############

----------------------------- Handle\_Sys\_Exec ---------------------------------

-- ############ NEW code ############

function Handle\_Sys\_Exec (filename: ptr to array of char) returns int

-- This function will read a new executable program from disk and copy it into

-- the address space of the process which invoked the Exec. This begins execution of the new program.

-- The implementation is similar to InitFirstProcess and StartUserProcess with some differences.

-- We have to work with 2 virtual address spaces. Since LoadExecutable may fail, thus our kernel must be able

-- to return to the process that was invoked with Exec with an error code.

-- This implementation will use a local variable of AddrSpace, and then coppy it into the PrcoessControlBlock.

-- The frames of the previous address space must be freed first!

-- We then need to copy the characters into an array variable (use MAX\_STRING\_SIZE)

var

ptrOpenFile2: ptr to OpenFile

newAddrSpace: AddrSpace = new AddrSpace

stringStorage: array[MAX\_STRING\_SIZE] of char

ptrToPCB: ptr to ProcessControlBlock

initPC: int

numOfBytes: int

initUserStackTop: int

ptrInitSystemStackTop: ptr to int

previousStatus: int

-- init newAddrSpace

newAddrSpace.Init()

-- Point to the currentThreads process

ptrToPCB = currentThread.myProcess

-- Get the filename into system space

numOfBytes = ptrToPCB.addrSpace.GetStringFromVirtual(&stringStorage, filename asInteger, MAX\_STRING\_SIZE)

if numOfBytes < 0

return -1

endIf

-- Open the executable

ptrOpenFile2 = fileManager.Open(&stringStorage)

if ptrOpenFile2 == null

return -1

endIf

-- create the LogicalAddress space using 'LoadExecutable'

-- And make sure to close the executable (otherwise a syste

-- recourse will become permanently locked up)

-- Check to see if there was an error loading a program into

-- memory

initPC = ptrOpenFile2.LoadExecutable(& newAddrSpace)

if initPC < 0

return -1

endIf

-- Compute the initial value(# of pages \* Page size) and then jump into the

-- user-level program

ptrToPCB.addrSpace = newAddrSpace

fileManager.Close(ptrOpenFile2)

frameManager.ReturnAllFrames(& currentThread.myProcess.addrSpace)

initUserStackTop = (newAddrSpace.numberOfPages \* PAGE\_SIZE)

ptrInitSystemStackTop = & currentThread.systemStack[SYSTEM\_STACK\_SIZE-1]

previousStatus = SetInterruptsTo(DISABLED)

currentThread.isUserThread = true

BecomeUserThread(initUserStackTop, initPC, ptrInitSystemStackTop asInteger)

return 3000

endFunction

-- ############ NEW code ############

----------------------------- Handle\_Sys\_Create ---------------------------------

-- ############ NEW code ############

function Handle\_Sys\_Create (filename: ptr to array of char) returns int

var

stringStorage: array[MAX\_STRING\_SIZE] of char

numOfBytes: int

numOfBytes = currentThread.myProcess.addrSpace.GetStringFromVirtual(&stringStorage, filename asInteger, MAX\_STRING\_SIZE)

--Check to see if theres an error when getting string from Virtual

if numOfBytes < 0

FatalError("ERROR: Error has occured in Handle\_Sys\_Create")

endIf

print("Handle\_Sys\_Create invoked!\n")

printHexVar("virt addr of filename = ", filename asInteger)

print("filename = ")

printString(&stringStorage)

print("\n")

return 4000

endFunction

-- ############ NEW code ############

----------------------------- Handle\_Sys\_Open ---------------------------------

-- ############ NEW code ############

function Handle\_Sys\_Open (filename: ptr to array of char) returns int

-- NOT IMPLEMENTED

var

stringStorage: array[MAX\_STRING\_SIZE] of char

numOfBytes: int

numOfBytes = currentThread.myProcess.addrSpace.GetStringFromVirtual(&stringStorage, filename asInteger, MAX\_STRING\_SIZE)

--Check to see if theres an error when getting string from Virtual

if numOfBytes < 0

FatalError("ERROR: Error has occured in Handle\_Sys\_Open")

endIf

print("Handle\_Sys\_Open called invoked! \n")

printHexVar("virt addr of filename = ", filename asInteger)

print("filename = ")

printString(&stringStorage)

print("\n")

return 5000

endFunction

-- ############ NEW code ############

----------------------------- Handle\_Sys\_Read ---------------------------------

-- ############ NEW code ############

function Handle\_Sys\_Read (fileDesc: int, buffer: ptr to char, sizeInBytes: int) returns int

-- NOT IMPLEMENTED

print("Handle\_Sys\_Read invoked! \n fileDesc = ")

printInt(fileDesc)

print("\nvirt addr of buffer = ")

printHex(buffer asInteger)

print("\nsizeInBytes = ")

printInt(sizeInBytes)

print("\n")

return 6000

endFunction

-- ############ NEW code ############

----------------------------- Handle\_Sys\_Write ---------------------------------

-- ############ NEW code ############

function Handle\_Sys\_Write (fileDesc: int, buffer: ptr to char, sizeInBytes: int) returns int

-- NOT IMPLEMENTED

print("Handle\_Sys\_Write invoked!\n")

print("fileDesc = ")

printInt(fileDesc)

print("\nvirt addr of buffer = ")

printHex(buffer asInteger)

print("\nsizeInBytes = ")

printInt(sizeInBytes)

print("\n")

return 7000

endFunction

-- ############ NEW code ############

----------------------------- Handle\_Sys\_Seek ---------------------------------

-- ############ NEW code ############

function Handle\_Sys\_Seek (fileDesc: int, newCurrentPos: int) returns int

-- NOT IMPLEMENTED

print("Handle\_Sys\_Seek invoked!\n")

print("fileDesc = ")

printInt(fileDesc)

print("\nnewCurrentPos = ")

printInt(newCurrentPos)

print("\n")

return 8000

endFunction

-- ############ NEW code ############

----------------------------- Handle\_Sys\_Close ---------------------------------

-- ############ NEW code ############

function Handle\_Sys\_Close (fileDesc: int)

print("Handle\_Sys\_Close invoked!\n")

print("fileDes = ")

printInt(fileDesc)

print(".\n")

endFunction

-- ############ NEW code ############

----------------------------- printString ---------------------------------

-- ############ NEW code ############

function printString( arg: String)

-- Helper function to print a char array string

print(arg)

endFunction

-- ############ NEW code ############

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endCode