Homework 4 Design and Tests

**Design and Implementation**

First of all, I would like to say that I added something to my InodeNumberLayer.py such that it would not link a file to a new directory such that the directory would end up containing two duplicate names. The code snippet that was added is pasted following the description page, and above the implementation of client\_stub.py and server\_stub.py. Next, my design and implementation was relatively straightforward and I also was able to optimize the way that I wrote my code such that both the client\_stub.py and server\_stub.py files are just about as lightweight as they can be. I did this by overloading the return instruction line such that it would it would un-marshal inputs, call its necessary function, and marshal the output or return data from functions before returning. Therefore, it will show that my client\_stub.py and server\_stub.py implementations seem rather lightweight, and that was on purpose. The only real difference between the two stubs is that my client\_stub.py file has all of its server calls within try-catch statements so that it will catch errors/faults and report them accordingly without causing a total program fault.

**Tests and Comparison to Local Filesystem**

Once I had fully written and implemented my code in the client\_stub.py and server\_stub.py files, I tested my code the same way that I tested my code for HW3 running the very same series of operations from the Filesystem.py python script and comparing the differences or issues between the two. Other than a few issues dealing with my need to add the inability for a link to create duplicate file names within a directory, there were no issues that I was able to find in my testing, except I had accidentally tabbed too far on a conditional else statement in my last implementation of FileNameLayer.py, so I fixed that as well, and hopefully that did not cause any major issues in my HW3 grading. Once I had verified functionality was working correctly, or at the very least, appeared to be working as expected, I added timing checks in both my local Filesystem.py implementation and the server/client implementation for this assignment. I tested each version 10 times, and of those 10 for each, 5 were including the filesystem initialization in the timing statistics, and 5 excluded that timing. I took the average of the 5 runs for each version and test type, and I found that Local with initialization included had an average timing of 2.03690434 seconds and without initialization had an average timing of 0.02059855 seconds. The server/client version with initialization had an average timing of 2.68415875 seconds, and without initialization had an average timing of 0.66032896 seconds. This shows that the initialization generally takes about the same amount of time in both cases, but that the server/client version takes about 33x longer to fully finish than the local implementation version. When there is a failure in the network, my implementation handles this using try-catch statements in the client stub, and if an error in the network comes about, then the catch statement will catch it and print out the error messages to the terminal.

# This is what was added to link() in InodeNumberLayer.py

# Add link to directory in new location

if not hardlink\_name in hardlink\_parent\_inode.directory.keys():

hardlink\_parent\_inode.directory[hardlink\_name] = file\_inode\_number

# Increment file\_inode ref count

file\_inode.links += 1

else:

print "\nError: Attempt to link two files with the same name in a single directory."

return -1

# BELOW HERE IS THE CODE FOR client\_stub.py AND server\_stub.py RESPECTIVELY #

# client\_stub.py

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# HW4 Part B

import xmlrpclib, config, pickle, time

class client\_stub():

def \_\_init\_\_(self):

self.proxy = xmlrpclib.ServerProxy("http://localhost:8000/")

# CLIENT REQUEST TO INITIALIZE THE MEMORY SYSTEM

def Initialize(self):

try:

self.proxy.Initialize()

except Exception as err:

# print error message

print "Error in re-initializing the filesystem."

quit()

#REQUEST TO FETCH THE INODE FROM INODE NUMBER FROM SERVER

def inode\_number\_to\_inode(self, inode\_number):

# Return the correct data

try:

return pickle.loads(self.proxy.inode\_number\_to\_inode(pickle.dumps(inode\_number)))

except xmlrpclib.Error as err:

print "A fault occurred in client\_stub.inode\_number\_to\_inode()"

print "Fault code: %d" % err.faultCode

print "Fault string: %s" % err.faultString

quit()

#REQUEST THE DATA FROM THE SERVER

def get\_data\_block(self, block\_number):

# Return the correct data

try:

return pickle.loads(self.proxy.get\_data\_block(pickle.dumps(block\_number)))

except xmlrpclib.Error as err:

print "A fault occurred in client\_stub.get\_data\_block()"

print "Fault code: %d" % err.faultCode

print "Fault string: %s" % err.faultString

quit()

#REQUESTS THE VALID BLOCK NUMBER FROM THE SERVER

def get\_valid\_data\_block(self):

# Return the correct data

try:

return pickle.loads(self.proxy.get\_valid\_data\_block())

except xmlrpclib.Error as err:

print "A fault occurred in client\_stub.get\_valid\_data\_block()"

print "Fault code: %d" % err.faultCode

print "Fault string: %s" % err.faultString

quit()

#REQUEST TO MAKE BLOCKS RESUABLE AGAIN FROM SERVER

def free\_data\_block(self, block\_number):

# Return the possible error, if no error, set retErr to 0

try:

return pickle.loads(self.proxy.free\_data\_block(pickle.dumps(block\_number)))

except xmlrpclib.Error as err:

print "A fault occurred in client\_stub.free\_data\_block()"

print "Fault code: %d" % err.faultCode

print "Fault string: %s" % err.faultString

quit()

#REQUEST TO WRITE DATA ON THE THE SERVER

def update\_data\_block(self, block\_number, block\_data):

# Return the possible error, if no error, set retErr to 0

try:

return pickle.loads(self.proxy.update\_data\_block(pickle.dumps(block\_number), pickle.dumps(block\_data)))

except xmlrpclib.Error as err:

print "A fault occurred in client\_stub.update\_data\_block()"

print "Fault code: %d" % err.faultCode

print "Fault string: %s" % err.faultString

quit()

#REQUEST TO UPDATE THE UPDATED INODE IN THE INODE TABLE FROM SERVER

def update\_inode\_table(self, inode, inode\_number):

# Return the possible error, if no error, set retErr to 0

try:

return pickle.loads(self.proxy.update\_inode\_table(pickle.dumps(inode), pickle.dumps(inode\_number)))

except xmlrpclib.Error as err:

print "A fault occurred in client\_stub.update\_inode\_table()"

print "Fault code: %d" % err.faultCode

print "Fault string: %s" % err.faultString

quit()

#REQUEST FOR THE STATUS OF FILE SYSTEM FROM SERVER

def status(self):

# Return the status string after marshalling the data

try:

return pickle.loads(self.proxy.status())

except xmlrpclib.Error as err:

print "A fault occurred in client\_stub.status()"

print "Fault code: %d" % err.faultCode

print "Fault string: %s" % err.faultString

quit()

# server\_stub.py

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# HW4 Part B

import xmlrpclib

from SimpleXMLRPCServer import SimpleXMLRPCServer

import time, Memory, pickle , InodeOps, config

filesystem = Memory.Operations()

# FUNCTION DEFINITIONS

# INITIALIZE THE FILESYSTEM

def Initialize():

# Marshal the response of Memory.Initialize()

retVal = Memory.Initialize()

retVal = pickle.dumps(retVal)

return retVal

#GIVES ADDRESS OF INODE TABLE

# Not so sure this needs to be implemented in this specific version

def addr\_inode\_table():

return pickle.dumps(sblock.ADDR\_INODE\_BLOCKS)

#RETURNS THE DATA OF THE BLOCK

def get\_data\_block(block\_number):

# Unmarshal the data for block\_number

return pickle.dumps(filesystem.get\_data\_block(pickle.loads(block\_number)))

#RETURNS THE BLOCK NUMBER OF AVAIALBLE DATA BLOCK

def get\_valid\_data\_block():

# Unmarshal the data and call the Memory Operations function

return pickle.dumps(filesystem.get\_valid\_data\_block())

#REMOVES THE INVALID DATA BLOCK TO MAKE IT REUSABLE

def free\_data\_block(block\_number):

# Marshal the input and call filesystem

return pickle.dumps(filesystem.free\_data\_block(pickle.loads(block\_number)))

#WRITES TO THE DATA BLOCK

def update\_data\_block(block\_number, block\_data):

# Marshal the input and call filesystem

return pickle.dumps(filesystem.update\_data\_block(pickle.loads(block\_number), pickle.loads(block\_data)))

#UPDATES INODE TABLE WITH UPDATED INODE

def update\_inode\_table(inode, inode\_number):

# Marshal the input and call filesystem

return pickle.dumps(filesystem.update\_inode\_table(pickle.loads(inode), pickle.loads(inode\_number)))

#RETURNS THE INODE FROM INODE NUMBER

def inode\_number\_to\_inode(inode\_number):

# Marshal the input and call filesystem

return pickle.dumps(filesystem.inode\_number\_to\_inode(pickle.loads(inode\_number)))

#SHOWS THE STATUS OF DISK LAYOUT IN MEMORY

def status():

# Marshal the input and call filesystem

return pickle.dumps(filesystem.status())

# Begin server listening

server = SimpleXMLRPCServer(("",8000))

print ("Listening on port 8000...")

# Registering all server functions below

server.register\_multicall\_functions()

server.register\_function(Initialize, "Initialize")

server.register\_function(addr\_inode\_table, "addr\_inode\_table")

server.register\_function(get\_data\_block, "get\_data\_block")

server.register\_function(get\_valid\_data\_block, "get\_valid\_data\_block")

server.register\_function(free\_data\_block, "free\_data\_block")

server.register\_function(update\_data\_block, "update\_data\_block")

server.register\_function(update\_inode\_table, "update\_inode\_table")

server.register\_function(inode\_number\_to\_inode, "inode\_number\_to\_inode")

server.register\_function(status, "status")

# Run the server

server.serve\_forever()