

# Project2 report

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I compile and test my program on Mac OS X v10.9 and Ubuntu 13.04

## 1. Architectural Document.

### a) A list of WHAT new functions I added.

1.Function in base.c and Queue.c

In Queue.c

```
DiskQueue *InitDiskQueue();
```

This function used to initialize diskqueue.

```
DISK InitDisk(PCB pnode, int token);
```

This function used to pack a PCB to a Disk node so that it can be pushed into diskqueue.

```
DISK EnQueueDisk(DiskQueue *queue, DISK pnode);
```

This function used to push a packed PCB node to diskqueue

```
DISK EnQueueDiskHead(DiskQueue *queue, DISK pnode);
```

This function used to pop a packed PCB node from diskqueue

In base.c

```
void initFrame();
```

used to initialize Frame when os start operate.

```
void shadow_page_table_Init();
```

used to initialize shadow\_page\_table when os start operate.

```
void DISKreadOrWrite(long diskID, long sectorID, char* buffer, int readOrWrite);
```

this function used to read data from disk to buffer if readorwrite=0 or write data in buffer to disk if readorwrtite=1.

```
void transfer(INT32 ID);
```

this function used to find PCBs that disk is no longer in use, and return them to readyqueue.

```
void FIFO(long status);
```

this function implement FIFO page replacement algorithm.

```
void sec_chance(long status);
```

this function implement second chance page replacement algorithm.

```
void mapping();
```

this function used to set up a shadow page table.

```
void findVictim();
```

this function used in second chance page replacement algorithm to find the victim page.

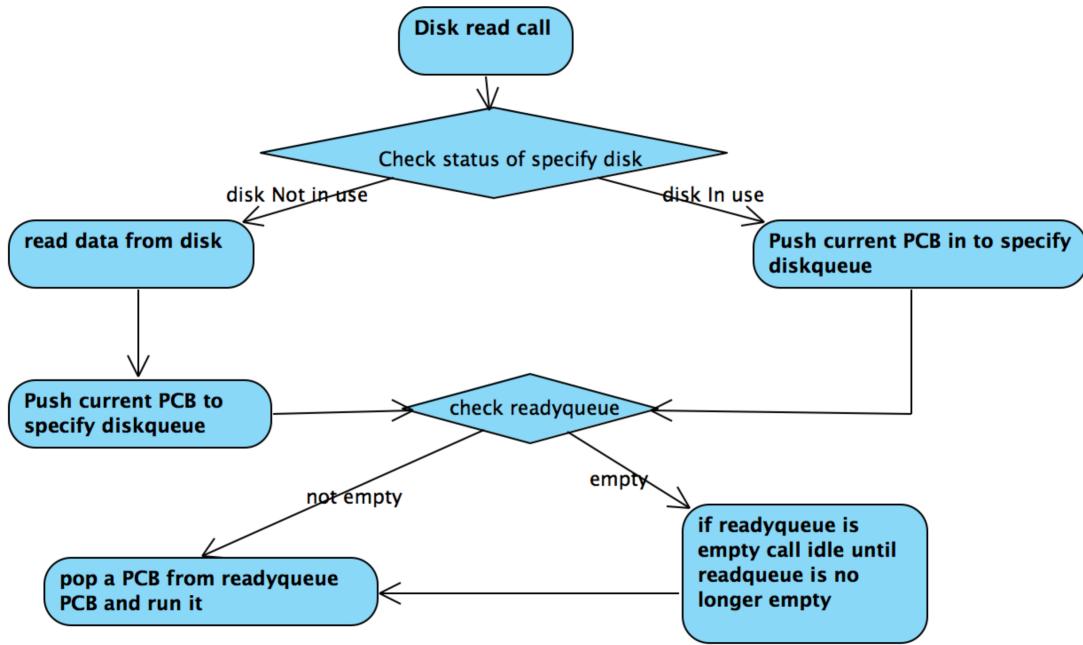
### b) High Level Design

There are two new system call added to my program **SYSNUM\_DISK\_READ** and

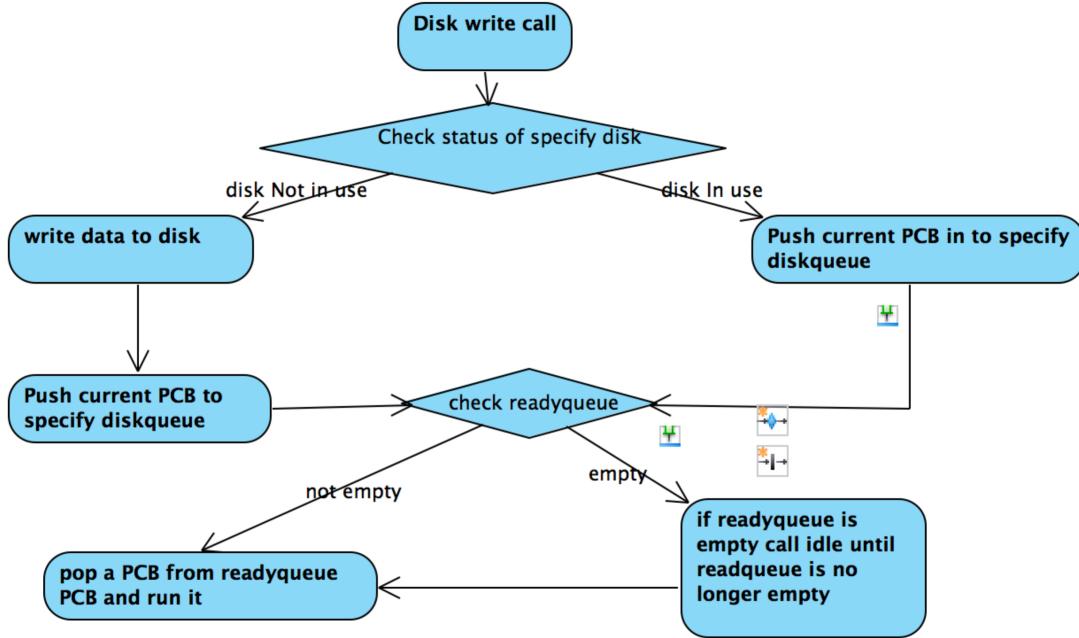
SYSNUM\_DISK\_WRITE.

This part include workflow diagram of two-addition system call, fault\_handler and interrupt\_handler.

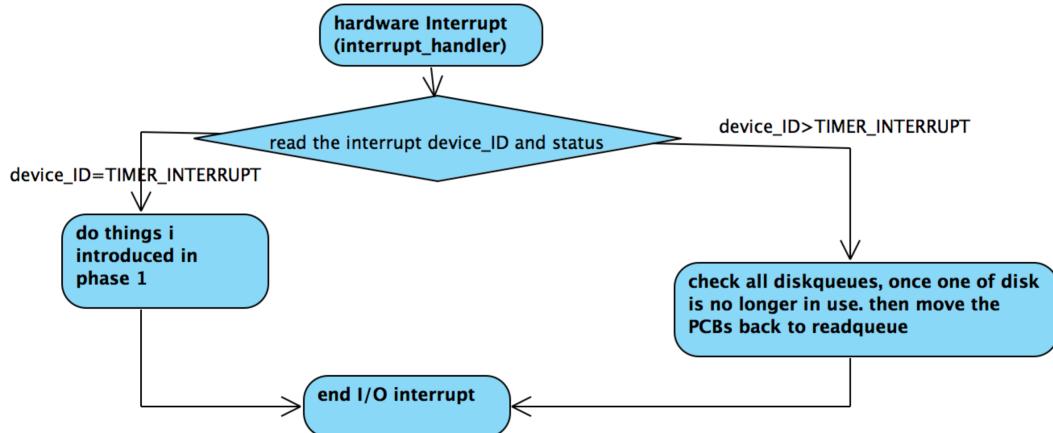
### 1. SYSNUM\_DISK\_READ



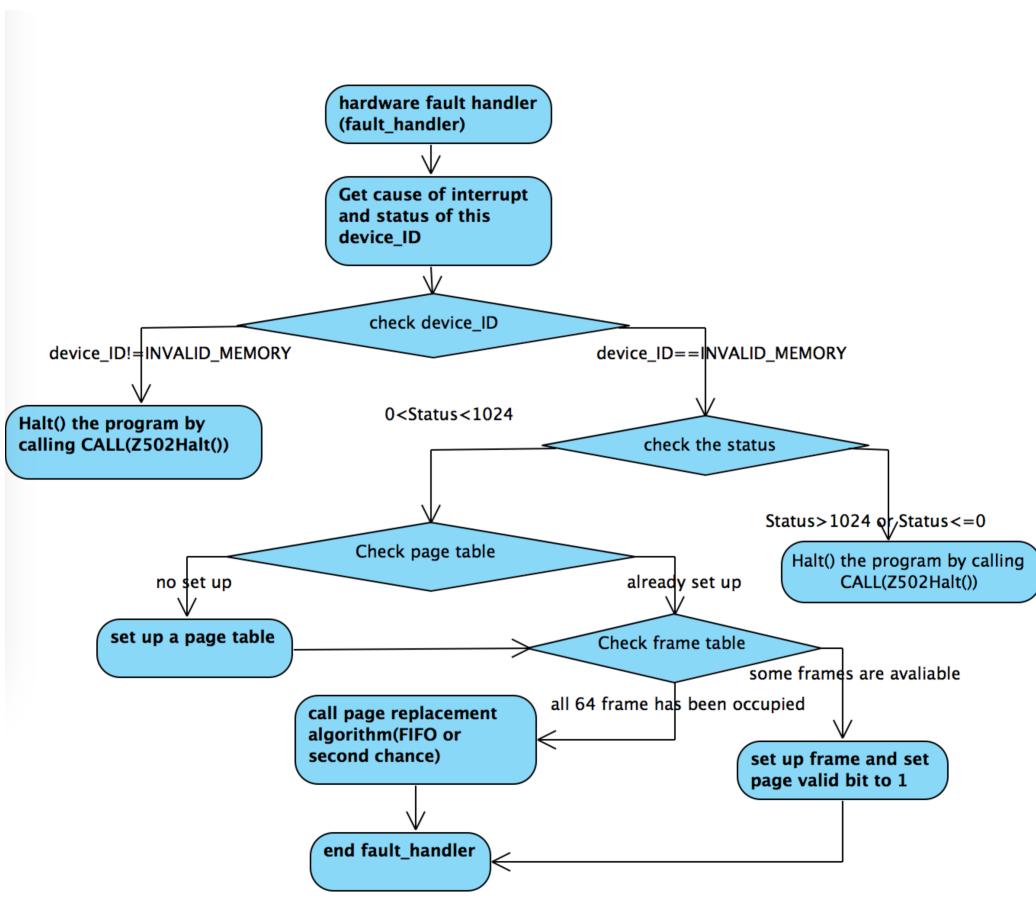
### 2. SYSNUM\_DISK\_WRITE



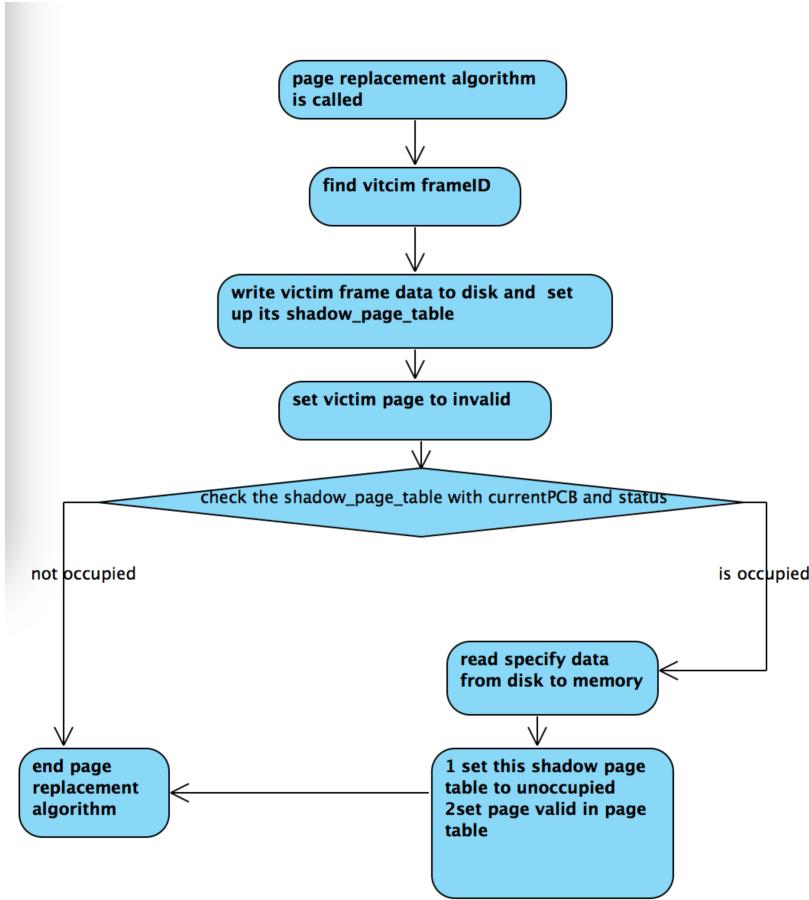
### 3. Interrupt handler routine



### 4. fault handler routine



## 5. page replacement algorithm



### c) Justification of High Level Design.

#### Structure

#### DiskQueue

The structure of diskqueue is like readyqueue and timerqueue, but each disk has its own diskqueue. Therefore there are several diskqueues instead of one.

#### Frame Tables

The frame table indicates what pages are being shared among several processes; the frame table totally has 64 frames, each frame stores information of a page that is in physical memory.

#### Shadow page tables

The shadow page table structures are used to describe how to find a virtual page of memory when it's not in physical memory. The shadow page table would hold disk information, for instance, indicating where to find the virtual contents should they need to be paged in.

How these tables relate to each other in my program.

### e) What is UNIQUE about your project

In my project I implement two page replacement algorithm, FIFO and second chance and compare these two page replacement algorithms in test2f.

The different between these two algorithms is that

Second chance is modify of FIFO. The advantage of second chance is that it avoid to throwing out heavily used page. But the disadvantage is that if there is no heavily used page, the performance of second chance is as same as FIFO.

What I expect is that the second chance page replacement algorithm will cause much less Faults than FIFO page replacement algorithm. But the fact is that there is no big change. Comparing to FIFO algorithm, the second chance only reduced 50-100 faults on average.

The following screenshots is the comparison of these two algorithms in test2f  
FIFO

```
Hardware Statistics during the Simulation
Disk 1: Disk Reads = 927: Disk Writes = 989: Disk Utilization = 0.652
Faults = 1053: Context Switches = 1917: CALLS = 198152
The Z502 halts execution and Ends at Time 298059
Exiting the program
```

second chance

```
Hardware Statistics during the Simulation
Disk 1: Disk Reads = 847: Disk Writes = 909: Disk Utilization = 0.648
Faults = 973: Context Switches = 1757: CALLS = 181865
The Z502 halts execution and Ends at Time 273354
Exiting the program
```

#### f) What anomalies and bugs did you find?

##### anomalies

For test2d if I run it on OSx, there is a error will occur most of the times. However I run it on Ubuntu, it works find. I have no clue how to solve it.

### 2. Source Code

```
base.c
Queue.h
Queue.c
```

### 3. Test Format

There are two variables `modelctrl` and `printerClt` I used in my program to control the output. If you set `modelctrl` as 0, the memory\_printer will print for every page fault. If you set it as 10, every ten-page fault, the memory\_printer only print once. For test2f, I set `modelctrl=100`. For test2e, `modelctrl=10`.

`printerClt=0`, `schedule_printer` will not print, Vice versa

### 4. Test Results

Test2a

```

        PHYSICAL MEMORY STATE
Frame 0000000000111111112222222233333333444444444555555556666
Frame 012345678901234567890123456789012345678901234567890123
PID   0
VPN   0
VPN   0
VPN   2
VPN   5
VMR   4

PID= 0 address= 412 written= 412 read= 412
SVC handler: term_proc
Arg 0: Contents = (Decimal)      -1, (Hex) FFFFFFFFFFFFFFFF
Arg 1: Contents = (Decimal) 4535454496, (Hex) 10E558B20

Time Target Action Run New Done      State Populations
 45     0       Term    0

Hardware Statistics during the Simulation
Faults = 1: Context Switches = 1: CALLS = 13
The Z502 halts execution and Ends at Time 45
Exiting the program
Tians-MacBook-Pro:~ test tianqianct □

```

test2b

```

ERROR - Lock is not currently locked by this thread. Caller = MemoryCommon
PID= 0 address= 46 written= 73 read= 73
PID= 0 address= 80 written= 87 read= 87
Fault_handler: Found vector type 2 with value 1023

        PHYSICAL MEMORY STATE
Frame 0000000000111111112222222233333333444444444555555556666
Frame 012345678901234567890123456789012345678901234567890123
PID   000000
VPN   000001
VPN   000000
VPN   000002
VPN   501233
VMR   777774

PID= 0 address= 16368 written= 16395 read= 16395
PID= 0 address= 80 written= 87 read= 87
Fault_handler: Found vector type 2 with value 1024

Hardware Statistics during the Simulation
Faults = 7: Context Switches = 1: CALLS = 43
The Z502 halts execution and Ends at Time 67
Exiting the program

```

test2c

```

Time Target Action Run New Done      State Populations
23906 0 change 0

Interrupt handler: Found device ID 5 with status 0

Time Target Action Run New Done      State Populations
24066 0 change 0

Interrupt handler: Found device ID 5 with status 0

Time Target Action Run New Done      State Populations
24226 0 change 0

TEST2C: PID 0, Ends at Time 24237

Time Target Action Run New Done      State Populations
24252 0 Term 0

Hardware Statistics during the Simulation
Disk 1: Disk Reads = 100: Disk Writes = 50: Disk Utilization = 0.620
Context Switches = 151: CALLS = 15447
The Z502 halts execution and Ends at Time 24252
Exiting the program

```

test2d

I keep schedule\_printer in 2d. if I did not, there is error will occur. I have not found a way to solve it.

```

end??????
Time Target Action Run New Done      State Populations
50517 0 Finish 0

```

```

Hardware Statistics during the Simulation
Disk 1: Disk Reads = 98: Disk Writes = 50: Disk Utilization = 0.027
Disk 2: Disk Reads = 200: Disk Writes = 100: Disk Utilization = 0.055
Disk 3: Disk Reads = 196: Disk Writes = 100: Disk Utilization = 0.054
Context Switches = 1087: CALLS = 36795
The Z502 halts execution and Ends at Time 550517
Exiting the program

```

test2e

```

PID= 0 address= 704 written= 11264 read= 11264
PID= 0 address= 700 written= 11200 read= 11200
PID= 0 address= 780 written= 12480 read= 12480
PID= 0 address= 224 written= 3584 read= 3584
PID= 0 address= 304 written= 4864 read= 4864
PID= 0 address= 20 written= 320 read= 320
PID= 0 address= 852 written= 13632 read= 13632
PID= 0 address= 244 written= 3904 read= 3904
PID= 0 address= 580 written= 9280 read= 9280
PID= 0 address= 464 written= 7424 read= 7424
PID= 0 address= 804 written= 12864 read= 12864
PID= 0 address= 792 written= 12672 read= 12672
SVC handler: term_proc
Arg 0: Contents = (Decimal) -2, (Hex) FFFFFFFFFFFFFF
Arg 1: Contents = (Decimal) 4307798784, (Hex) 100C3CB00

```

```

Time Target Action Run New Done      State Populations
1238 0 Finish 0

```

```

Hardware Statistics during the Simulation
Faults = 60: Context Switches = 1: CALLS = 1209
The Z502 halts execution and Ends at Time 1238
Exiting the program

```

test2f

```
PHYSICAL MEMORY STATE
Frame 000000000011111112222222233333333444444444455555555556666
Frame 012345678901234567890123456789012345678901234567890123
PID 000000000000000000000000000000000000000000000000000000000000000
VPN 000000000000000000000000000000000000000000000000000000000000000
VPN 1000001010001011000101100000110001000000000000100000000000001000
VPN 1307070204271922023117010586782207409055709366861991463989880536
VPN 8648274607363030747864929383926453661648078186991937044657761680
VMR 55555555555555555555555555555555545555555555555555555555555555555

----- Report by test2f - Pid 0 -----
Pid = 0, Pages Touched = 2300
PID= 0 address= 1472 written= 1472 read= 1472
----- Report by test2f - Pid 0 -----
Pid = 0, Pages Touched = 2400
TEST 2f, PID 0, HAS COMPLETED 2 ITERATIONS
SVC handler: term_proc

Hardware Statistics during the Simulation
Disk 1: Disk Reads = 952: Disk Writes = 1014: Disk Utilization = 0.653
Faults = 1078: Context Switches = 1967: CALLS = 203268
The Z502 halts execution and Ends at Time 305818
Exiting the program
.
.
.
test2g
sorry I failed
test2h
I have no time to try it.
```