CS444 Assignemnt IV Writeup

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Abstract

This is the write-up for Homework IV of the operating system II. The content includes the design, the version control log, the work log, and the answered questions.

1 Introduction

In this assignment, we need to understand how the SLOB first-fit algorithm works and implements the best-fit allocation algorithm. We have to write a program that computes the efficiency of the first-fit algorithm and best-fit algorithm and compares the fragmentation suffered by each algorithm. This will require the addition of a system call which returns actual memory usage.

2 Thinking and Design

The SLOB allocates memories with the first fit algorithm, that is, the SLOB is trying to be efficient enough to assign requests into the memory, hence the first position it finds that fits the size of the requests would be in use. Under the first fit algorithm, the kernel jumps in the first space available for the incoming requests; it does not consider whether the chosen space is the best fit (that is, the best possible fit after taking into consideration of all the spaces) for the request. In this assignment, our team needs to write the best fit algorithm.

First, we have to understand the SLOB first fit algorithm; then we can implement the best fit algorithm based on the SLOB. The best fit algorithm needs the scan of all the available space before the allocation. This search mechanism causes the time spend on the best fit algorithm is usually longer but more efficient for the space usage. We need to check each page for the best fit block size and then allocate the memory.

3 Version control log

Date	Person	Message
Sat Nov 26	Xilun Guo	Testing on new slob file
Sat Nov 26	Xiaomei Wang	slob file
Sat Nov 26	Chauncy Yan	Update everything

4 Work Log

Date	Person	Task
Thu Nov 10	Chauncey Yan	Figure out how to use kernel module
Fri Nov 11	Chauncey Yan	Kernel module injection
Fri Nov 11	Xilun Guo	Analyze original SLOB first fit algorithm
Fri Nov 11	Xiaomei Wang	Testing original SLOB.c
Fri Nov 25	Xiaomei Wang	Write the best fit algorithm
Sat Nov 26	Xiaomei Wang	Testing new SLOB.c
Sat Nov 26	Xilun Guo	Debug
Sat Nov 26	Chauncy Yan	Debug
Sat Nov 26	Xilun Guo	Finish up with better code
Sat Nov 26	Chauncy Yan	Finish up

5 Questions

5.1 What do you think the main point of this assignment is?

The main points of this assignment is to understand how the SLOB first-fit algorithm works and implement the best-fit allocation algorithm. You must also write a program that computes the efficiency of the first-fit algorithm and best-fit algorithm and compares the fragmentation suffered by each algorithm. This will require the addition of a system call which returns actual memory usage.

5.2 How did you personally approach the problem? Design decisions, algorithm, etc.

Linux Kernel Setup: First, we use "make menuconfig" to set the kernel configuration option, the SLAB and SLOB allocator is both inside the general setup; select the SLOB. Second, "make -j8" to compile the main kernel, and then "make modules" and "make module_install" to compile and install the kernel modules. Finally, "make install" will install the new kernel.

Within the *slob_ alloc()* function the first page that comes along is sent to the *slob_page_ alloc()* function for allocation. We created a function that will return the best fitting block within the current page. This is used to compare each page with each other to ensure that we indeed have the best fit. The function is essentially the same as the function without the allocating code.

5.3 How did you ensure your solution was correct? Testing details, for instance.

We wrote a test script in the virtual machine to test if the solution is right or wrong utilizing system calls with the designed system call number. The result was as expected.

5.4 What did you learn?

1. Make modification on existing simple list of blocks memory allocation algorithm.
2. Learn how to use system call, and how the system call works.
3. How to write a best fit algorithm for memory allocation.
4. Learn the difference between the best-fit and the first-fit algorithm.