Project Design Document

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Github Link: https://github.com/oscomp/proj19-process-memory-tracker

Main Topic: process-memory-tracker (实时统计进程内存使用及检测内存泄漏)

Project Background and Description:

> According to the project description in the github repository, consult relevant materials to improve the project background.

There are several tools for showing memory usage in Linux by process and user:

- `ps` : The very basic way to show memory usage in Linux is using ps and it is available to check all the processes on Linux.
- `top` : One extremely easy way to see what processes are using the most memory is to start top.
- `pmap` : With the PID of the processes need to check memory usage, run pmap adding with PID to show not only the total memory used in process but also the memory libraries and other files required to run this particular process.

The memory leak is a type of resource leak happens when computer programs manage the memory defectively. There are 2 ways to cause memory leak problem in OS level: the first one is that the memory is not freed after the data no longer being used, and the another cause is missing deletion of pointer, which leads the memory never usable. And it is a particularly serious issue for large scale programs.

To detect the memory leak, memprof is a tool for profiling memory usage and finding memory leaks. It can generate a profile how much memory was allocated by each function in your program. Also, it can scan memory and find blocks that you've allocated but are no longer referenced anywhere as. And there are some other tools for detecting memory leak as well: HeapAnalyzer, JRockit Memory Leak Detector, Valgrind, etc.

Implementation

> According to the project background and expected goals, clarify the technical route, list the main technologies used in the project, and the main innovation points.

Technical Route and Technologies

Based on knowledge and technologies of Linux and Linux kernel, we will try to use C or C++ to write the main logic code. Besides, some shell scripts may be generated as well. We will use github repository as our code storage. Some techniques in the background part of this document may be used for references. And we may use vim, clion or VS code as our development tools to write codes.

Main Innovation Points

There are several innovation points we propose to implement. Firstly, we think about the features of our primary objective, real-time statistics of system processes and their thread memory usage. We would make the display available for sorting based on different conditions and make it a real-time display with refresh rate set by the user. Secondly, most common methods to show memory usage only display details on process level, but we will try to go deep into the memory usage of thread. Thirdly, we will also try to make our algorithm and design more efficient and reliable, both for our primary goals and attempt goals.

Expected Goals

> The expected goals can be the expected goals listed in the repository, or based on the project background, put forward your own ideas and propose suitable project goals.

Suggested tasks in proj19-process-memory-tracker

> ### 第一题：实时统计系统进程及其中线程内存使用情况
>
> - 编码来实现对于内存使用信息的统计，并对内存统计数据进行进行排序并实时显示；
>
> ### 第二题：检测某个进程中的内存分配释放
>
> - 编码实现检测具体进程中内存分配与释放；
> - 编码实现检测具体进程中文件句柄的分配与释放；
>
> ### 第三题：检测某个进程中的内存是否存在泄漏
>
> - 统计进程内存分配和释放的情况，确认是否存在泄漏情况，如有泄漏指出泄漏可疑处代码；

We select problem 1 as our primary task, that is, we will implement a program to record information of memory usage, then sort and display these information in real time. This program can also output these information to a file.

We will also discover relation between problem 1 and problem 2 3, and try to complete part of them according our ability and time. We will attempt to add these modules to our program, such as tracking specific thread in a process, detect memory leak, find the suspected memory leak segment.

Our specific design goals are as follows.

Program primary goals:

- record information of memory usage for all processes in Linux
- sort and display these information in real time

- output the selected information to a file

Program attempt goals:

- detect memory leak in Linux
- locate potential segment causing memory leak
- detect detailed memory allocation and release for a specific process
- tracking memory usage of specific thread in a process

Division of Labor

> List the main division of labor for each team member

We would search the relative materials and analyze the approaches to the implementation together. And then we can determine the specific division of labor for our team.