CS 746 : Linux Kernel Programming

Assignment 1: Part 1
Estimating resident-set-size of processes

Submitted by

Aurobindo Mondal
143050082

Under the guidance of

Prof. Purushottam Kulkarni

Department of Computer Science and Engineering
IIT Bombay

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Estimating resident-set-size of processes

Algorithm to find RSS :

- Create a structure to store rss and vmsize of each vmarea.
- Get task_struct and vm_area_struct of the pid (taken as command line arg) process using the command :

```
task = pid_task(find_vpid(pID), PIDTYPE_PID);
vma = task->mm->mmap;
```

- Estimate RSS value : follow pseudo code below.
  - ✓ print rss and vmsize of each vmarea
- Print the RSS and VMSIZE and free Linked list memory
- Verify the output with the output of smaps using :

```
RSS :       grep "Rss" /proc/<pid>/smaps | awk '{s+=$2} END {print s}'
VMSIZE:     cat /proc/<pid>/status | grep "VmSize"
```

Pseudo Code to estimate RSS :

```
for each vmareas of pid process :
     for each page in each vmarea :
          pte = do_page_walk(page);   // pte = pgtable entry for each page
          vmsize++;                   //increment vmsize
          if(pte==NULL):
               PAGE UNMAPPED;
          else :
               if(pte_present(pte)): // if present bit of page set
                    PAGE PRESENT IN RAM;
                    rss++;           // increment RSS for each vmarea
                    phyAddr = pte_pfn(*pte)<<PAGE_SHIFT;
                    print phyAddr;
               else:
                    PAGE NOT PRESENT IN RAM;
          insert_into_linked_list(rss,vmsize);
```

```
      totalRss += rss;                  // add rss to total rss
      totalVmsize += vmsize;            // add vmsize to total vmsize
```

Pseudo Code for page walk :

```
FUNCTION do_page_walk(mm_struct *mm, page) :
      pgd = pgd_offset from mm and page;
      if(invalid pgd)
            return NULL;
      pud = pud_offset from pgd and page;
      if(invalid pud)
            return NULL;
      pmd = pmd_offset from pud and page;
      if(invalid pmd)
            return NULL;
      pte = pte_offset from pmd and page;
      return pte;
```

Results and Observations :

Output from module :

```
$ sudo insmod rss.c && dmesg
...
[ 5799.291651] VmSize = 27552 KB || Number of VmPages = 6888
[ 5799.291653] RSS = 6308 KB ||  Number of RSS = 1577
```

Output from smaps :

```
$ cat /proc/5023/status | grep "VmSize"
VmSize:        27552 kB
$ grep "Rss" /proc/5023/smaps | awk '{s+=$2} END {print s}'
6300
```

Conclusion :

- The VmSize calculation is accurate.
- The Rss calculation is very close. There is a difference of 2 pages.