Homework
Part 1: Virtualization – 3) Memory 1

master@9d527ee (20210310-164612)

P. Mainini, C. Fuhrer, E. Benoist

BTI1341 / Spring 2021

1 Address Spaces

1.1 Understand the UNIX Memory API ★

If you don't feel at home allocating memory in C programs, refresh your knowledge by reading *OSTEP, Chapter 14* ([ADAD]) and conduct the corresponding homework. At least, review Section 14.4 regarding common mistakes which can be made.

1.2 The Linux Address Space

Write a program in C. This program must contain the main function and another function. In the main function, you have the following variables:

- `argc` and `argv` that are the arguments to the function,
- a an automatic variable
- b a static variable
- pc a pointer, that is initialized using a malloc
- Pointer on a constant string.

You pass pc as an argument to the function.
In the function you have to use the following variables

- An automatic variable v
- A static variable s
- p1 a pointer given as an argument.
- p2 a pointer you intialize with a malloc

For each of the variables, you have to print out the pointer.
Run the process in a shell ignoring ASLR.

```
setarch `uname -m` -R /bin/bash
```

Give the address spaces of the following variables:

- Automatic
- Malloc initialized
- Static
- Arguments of program
- Arguments of function

They should be grouped in three groups: Static memory, Stack, Heap

2 Address Translation

2.1 Address Translation Simulation

Conduct the simulation homework from *OSTEP, Chapter 15* (`relocation.py`), found at [ost]. The tasks to be performed are described at the end of the respective chapter PDF.

★ Question 5 is optional.

3 Segmentation

3.1 Segmentation Simulation

Conduct the simulation homework from *OSTEP, Chapter 16* (`segmentation.py`), found at [ost]. The tasks to be performed are described at the end of the respective chapter PDF.

References

[ADAD] Remzi H. Arpaci-Dusseau and Andrea C. Arpaci-Dusseau, *OSTEP chapter 14, memory API*, http://pages.cs.wisc.edu/~remzi/OSTEP/vm-api.pdf.

[ost] *OSTEP homework*, http://pages.cs.wisc.edu/~remzi/OSTEP/Homework/homework.html.