Systems Programming

A3, A4

Luca Mayr / Christian Rieger

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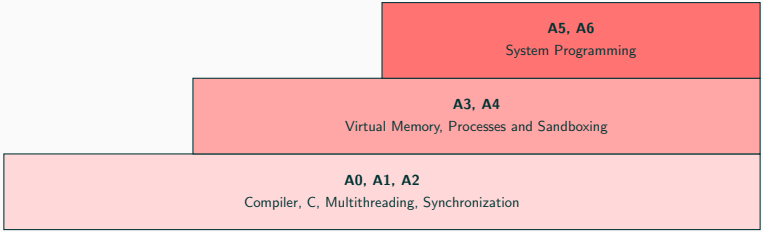
IAIK – Graz University of Technology

A3 - Virtual Memory

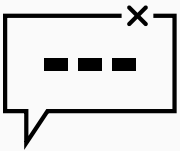
A4 - Interprocess Communication

Course Overview



A3 - Virtual Memory

Segmentation fault



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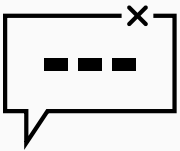

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- This fault handler can abort the user program or **fix the situation** by “making” the address valid
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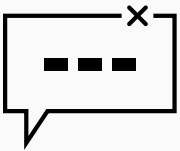

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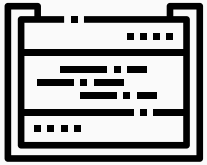
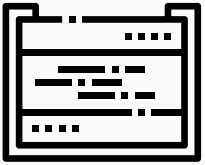
- The OS invokes a fault handler
- This fault handler can abort the user program or **fix the situation** by “making” the address valid
- Efficient: Don’t assign memory until necessary
- Are pointers addresses in physical memory?
  - How can addresses in physical memory be “invalid”?

- **Pointers are not addresses in physical memory**





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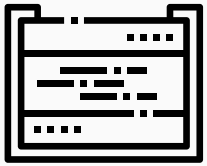

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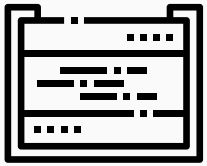

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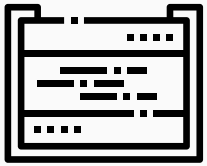

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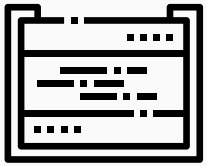

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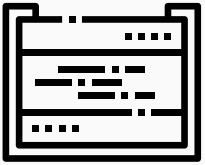

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→ different processes can use the same addresses, but “see” different things there

- Experiment with different kinds of variables, which addresses do they get?
- Observe memory usage in practice, when does it really increase?
- **Answer questions from the test system questionnaire!**
- **Register + participate in one of the virtual memory discussions!**

A4 - Interprocess Communication

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- Just change the functions which are marked with TODO
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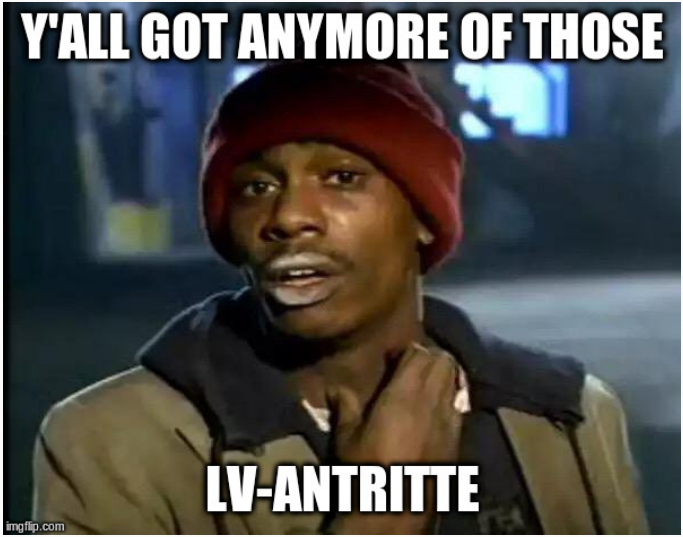
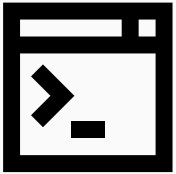
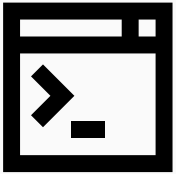
- Use the man pages to get this information, or just use google
- Take a look at Assignment A2 you will need to use semaphores again :-)


INTER PROCESS
COMMUNICATION
IGNORE


Y'ALL GOT ANYMORE OF THOSE
LV-ANTRITTE
imgflip.com



- e.g. using a shell on Linux



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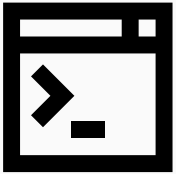

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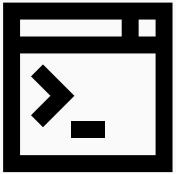


- e.g. using a shell on Linux
- the shell is a process itself
- executing a program with ./program
- $\rightarrow$ the program starts

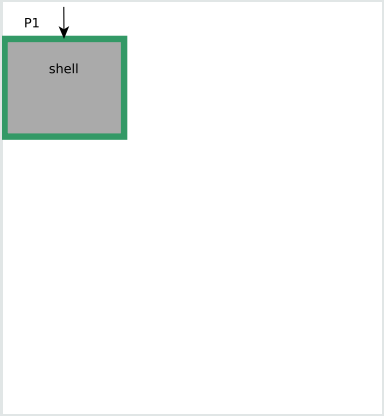
Code

```
$ ls ~/
```

Code

```
//shell stuff
```

Image



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pid_t pid = fork();
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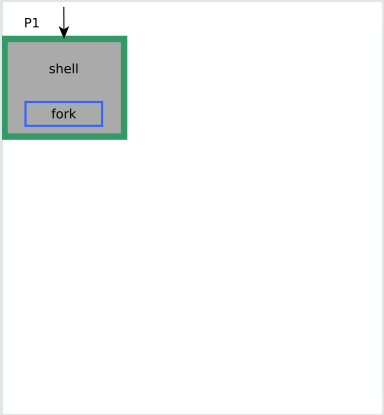

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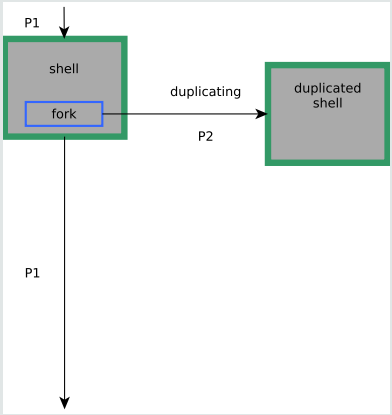

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pid_t pid = fork();
if(pid == 0)
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  const char* args[] = {"~/"};
}
else
{
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```

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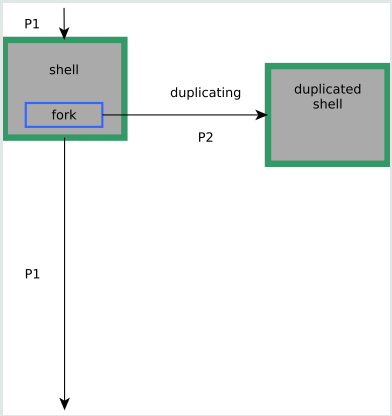

Code

```
//shell stuff

pid_t pid = fork();
if(pid == 0)
{
  const char* args[] = {"~/"};
  execv("/bin/ls", args);
}
else
{
  //do further shell stuff
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```

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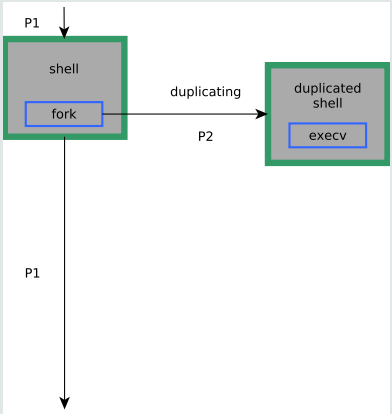

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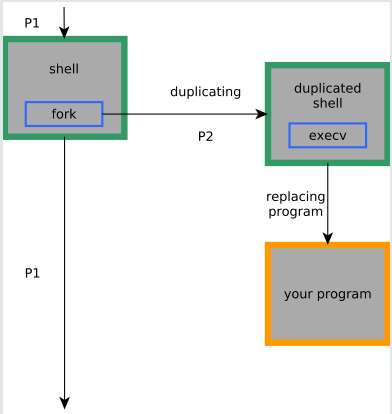

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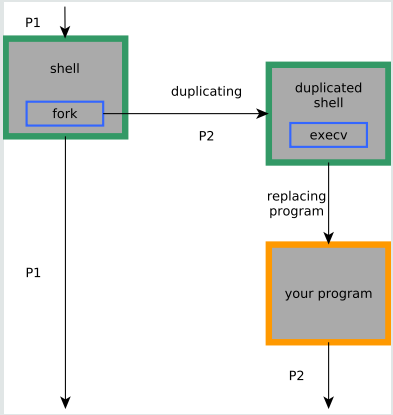
P1
shell
fork
duplicating
P2
duplicated shell
execv
replacing program
your program
P1
P2

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3. the forked process will be emptied
4. your program will be filled into the empty process
5. execution of your main starts

- `fork` followed by an `exec`
  - Worse than just creating a process

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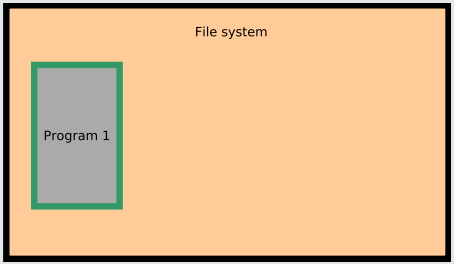
  - Worse than just creating a process
  - No, because of COW:
    - Forked process shares memory with the old process
    - Memory is copied upon write access

    → Almost nothing copied if followed by an `exec`!

Code

```
/* something in the main or whatever
   */
```

Image



Code

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/* found in (/dev/shm/obj)  */
int fd = shm_open("obj",O_RDWR,0644)
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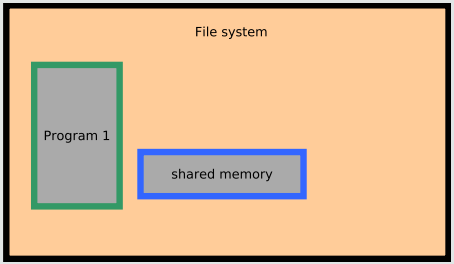

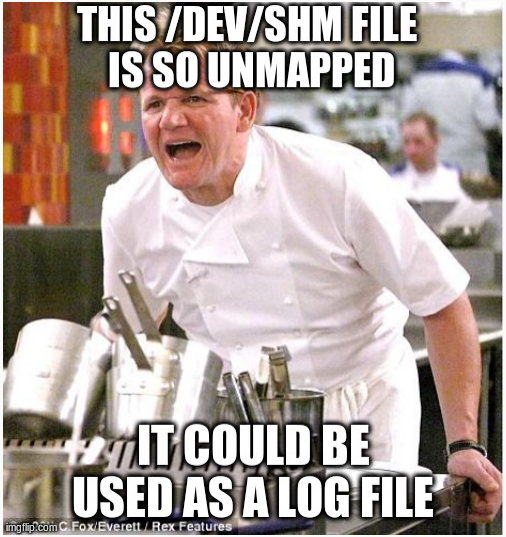
THIS /DEV/SHM FILE
IS SO UNMAPPED
IT COULD BE
USED AS A LOG FILE
imgflip.com
C. Fox/Everett / Rex Features


WHY DON'T WE
TAKE THE SHM FILE
AND MAP IT INTO
THE VIRTUAL MEMORY

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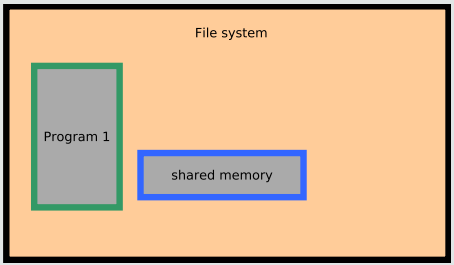

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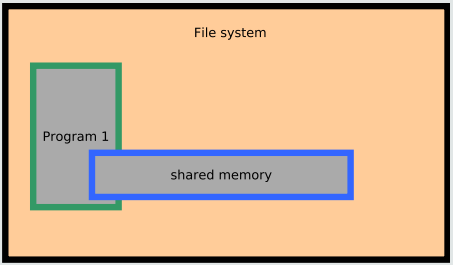

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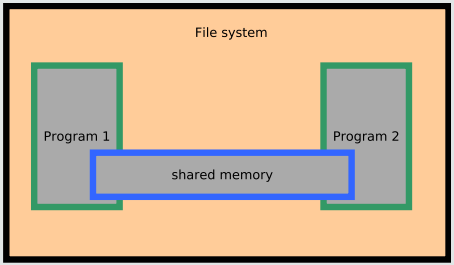

Thanks for your attention!