TECHNISCHE UNIVERSITÄT DRESDEN

Faculty of Computer Science Institute for System Architecture, Operating Systems Group

MKC – Exercise 3

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Roadmap

- Create new Execution Contexts (threads)
- Manage ECs in a (double linked ring) list
- Switch between them (cooperatively)

- Hands-on
  - User-level threading
  - 1st “real” system call: create_ec
  - 2nd system call: yield

Get the Code

```
$ git clone
https://os.inf.tu-dresden.de/repo/git/mkc.git
$ git checkout exercise3

# build it
$ make

# run it
$ make run
```

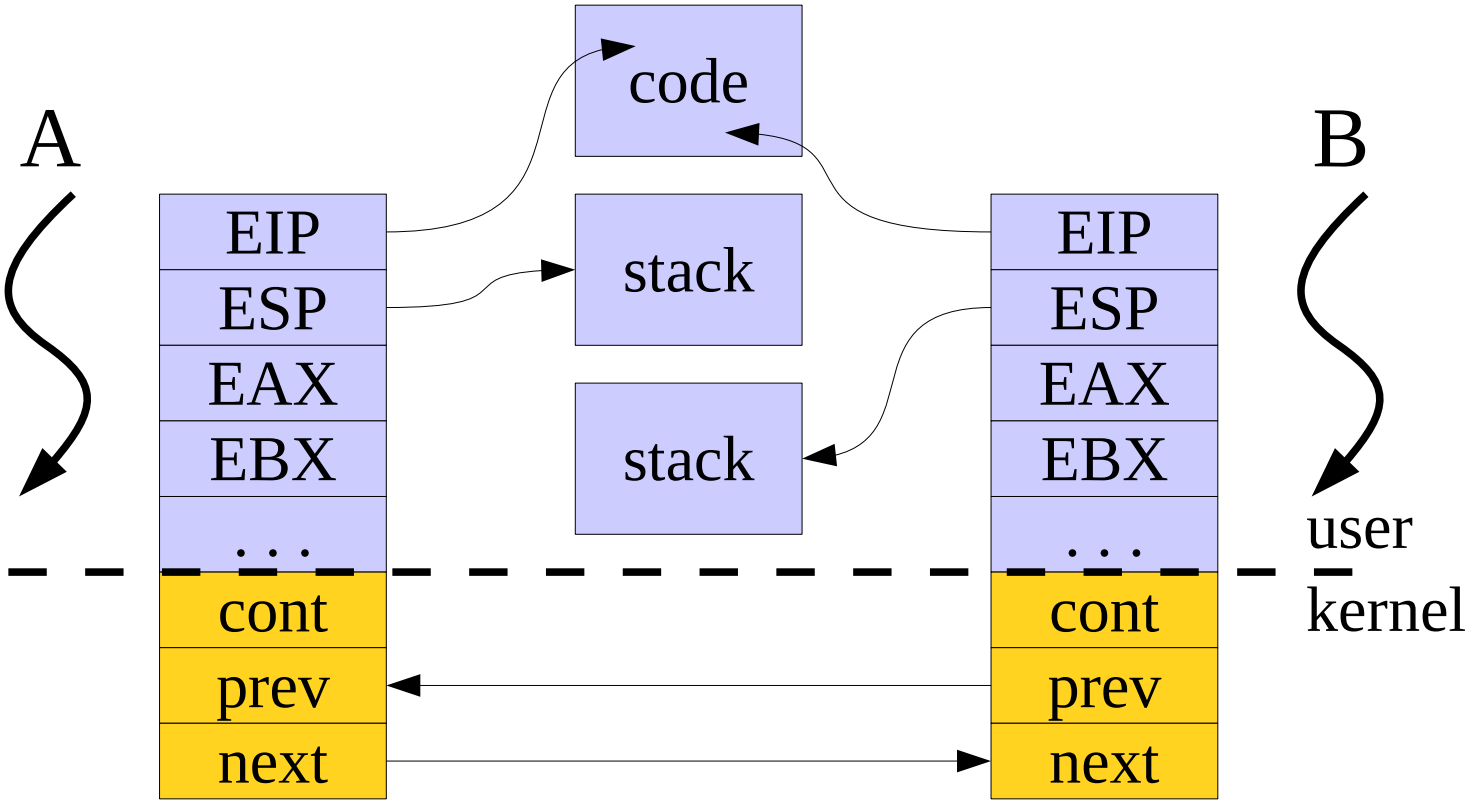
Scheduling

- Very very simple scheduler
  - No priorities, no time budgets
  - Cooperative multithreading
  - Single address space, uniprocessor

- Kernel: kern/include/ec.h
  - Registers (state)
  - Continuation (where to continue execution)
  - Management information (e.g. ***prev**, ***next**)

- User: user/src/user.cc
  - Code (instruction pointer)
  - Most likely a Stack (stack pointer)

What is a Thread/EC?



New User Level Thread

- Thread function: no parameter, nothing to return, but needs a stack
- Where to get the new stack from? malloc() → not available (so far)
- Put it statically in data segment or on local stack of the currently running thread: **char new_stack[64];**
- Stack grows downwards, thus ESP should point to the end: **new_stack + sizeof(new_stack)**

Task 0 : Minimal Thread User Code

- Write a new thread function in user/src/user.cc
  - Simple function doing nothing but spinning
  - Later it shall call **sys_yield()**, thus switching to the next thread

- New bindings for to-be-written syscalls:
  - **sys_create_ec** (2 arguments):
    - Creates a shining new Execution Context
    - EIP of new EC (thread function's address)
    - ESP to be used – we need a user stack per EC
  - **sys_yield** (no argument)
    - Simply switches to the next thread

Task 1 : sys_create_ec

- Organize ECs in a ring list
  - add **prev** and **next** pointer (kern/include/ec.h)
  - Private **enqueue()** function, adding **this** to the tail of the list (kern/src/ec.cc)
  - Special case when creating very first EC, **Ec::current** is not yet set, watch out!

- Add a new system call
  - Two parameters (instruction and stack pointer)
  - Ec::sys_regs() and kern/include/regs.h
  - Create **new EC**, add it to the list, and sysexit
  - Verbose printf, newly created EC, its EIP/ESP, maybe even the whole list of ECs

Task 2 : sys_yield

- Switch from currently running EC (**Ec::current**) to next one (**current->next**)
  - Every EC has a continuation – the function to execute whenever becoming ready (again)
  - The currently running thread shall continue with **ret_user_sysexit**, thus set **cont** accordingly
  - Switch to **current->next** via **make_current()**
- Create more threads in user application, printf whenever they yield: **EC:%p → EC:%p**