

Introduction to Mathematical Software 2008



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■ Persons

- Dr. Ulf Lorenz
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Room S2 | 15 230
Office hours: Tuesday, 9:30 – 10:30

- Dipl.-Math. Christian Brandenburg
Email: brandenburg@mathematik.tu-darmstadt.de
Room S2 | 15 229
Office hours:

- Technical support:
 - <http://www.rbg.informatik.tu-darmstadt.de> (C 119)
 - Sebastian Hamann, probably in S2 | 15 317
Mo, 13:15 – 14:15; Tu 10:45 – 11:45

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- Topics
 - Mathematics with a computer
 - UNIX/Linux
 - Maple
 - C / C++ programming

- Schedule
 - Lectures: 15.10., 22.10., 5.11., 19.11., 3.12., 17.12., ...
 - Exercises: 27.10., 10.11., 24.11., 8.12.,...

- Rooms
 - Wednesday, 16:15 – 17:55 --- S103/123
 - Monday, 8:00 – 9:40 --- S2|02 C005 (Piloty building)

- Dates
 - Webpage:
<https://www3.mathematik.tu-darmstadt.de/?id=84&evsid=23&evsver=29>
 - Integrated course: lectures and computer exercises alternate
 - Exercises will be worked on in groups up to 3 students
 - One (or more) homework assignments to pass this course
 - **MOST IMPORTANT: For being able to participate in the exercises, you will need an account and password from the computer science department!**



- How to get an account in the CS department

- Go to

- <https://www3.mathematik.tu-darmstadt.de/?id=84&evsid=23&evsver=29>

- Click [Anmeldung zu Introduction to Mathematical Software](#)

- **You have time until 20th Oct. 2008, 16:00**

- You will need your HRZ identification and your Matrikelnummer.**

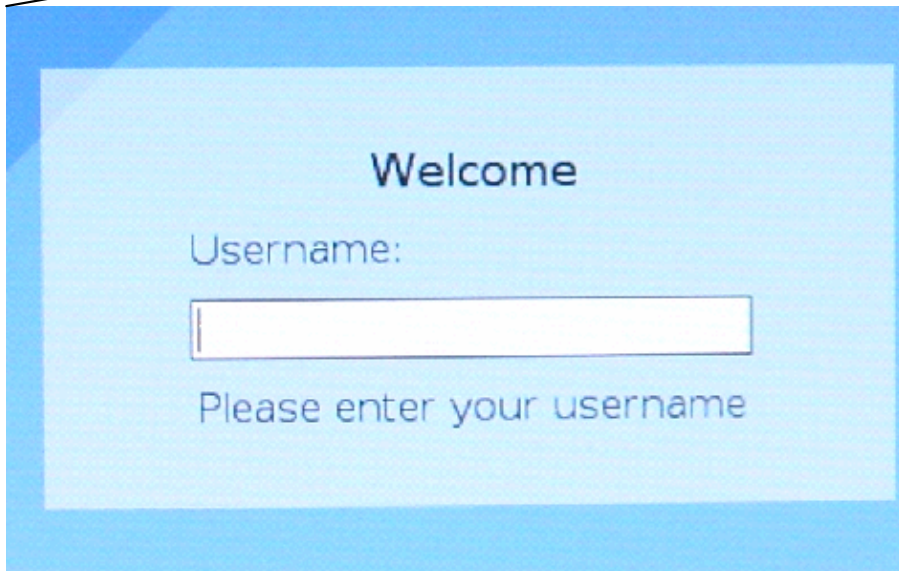
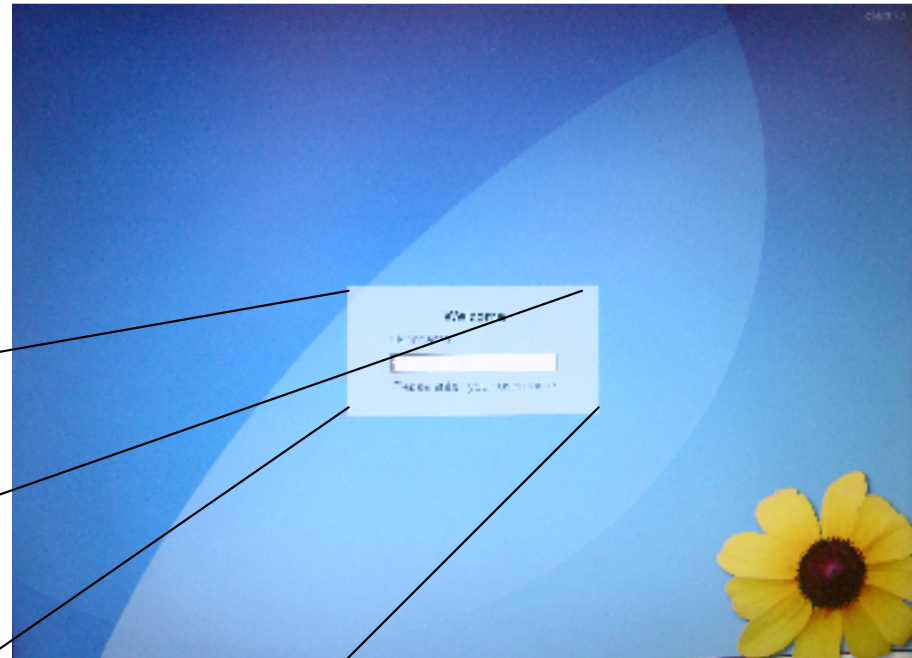
Then, your lecturer will give the list of data to the CS department, and from Oct. 23rd, you can pick up your

- **Passwords in room S2 | 02-C119, CS department**

Organisation



- How to login

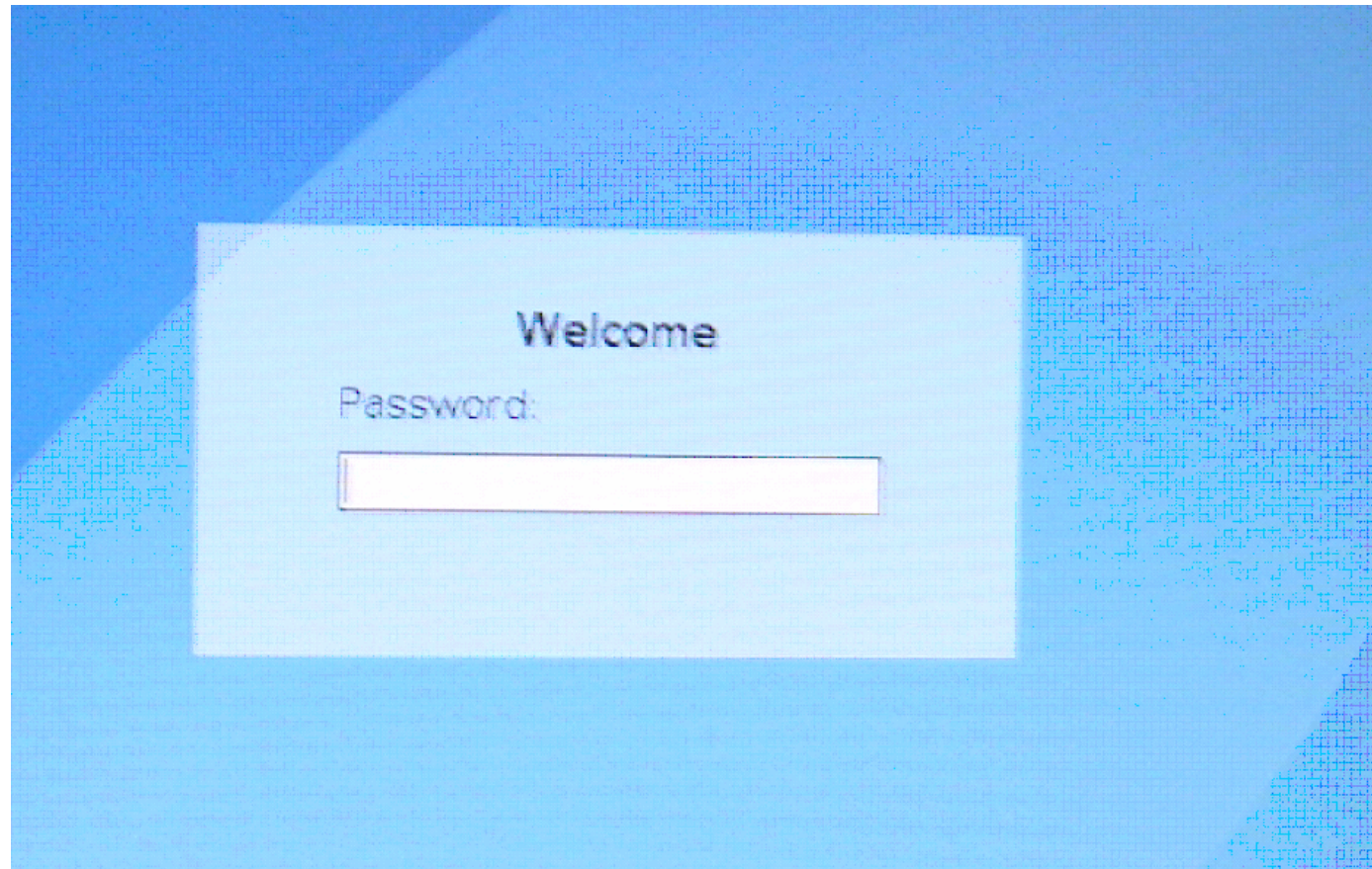


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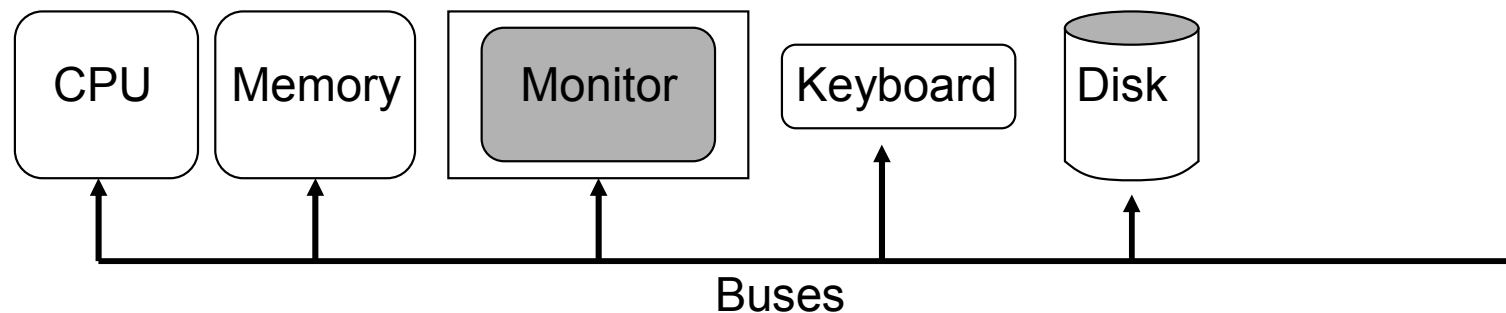
- How to login



- Hardware, described on a specific level of detail

Your computer mainly consists of 5 units that are connected via so called “busses”. These units are

- The CPU (Central Processing Unit)
- Main memory,
- Monitor
- Keyboard
- Harddisk



- CPU
 - contains a few memory cells, so called registers
 - interpretes sequences of 0s and 1s as sequences of instructions, like “set a register to 0”, or “add the content of a register to a memory cell“
 - A well defined sequence of instructions is called a “program”.

- Main memory
 - Consists of many so called bits with value 0 or 1. Typically, bits are grouped to so-called bytes (= 8 bits) and the main memory size is expressed with the help of its number of bytes. Typically, a personal computer has between 512 Mbyte and 32 Gigabyte.
 - Programs can be loaded into the memory.
 - Programs can write data into the main memory, or they can read data from the main memory.
 - Access from the CPU to the cells of the main memory is slower than the access to its registers, but faster than the access to the

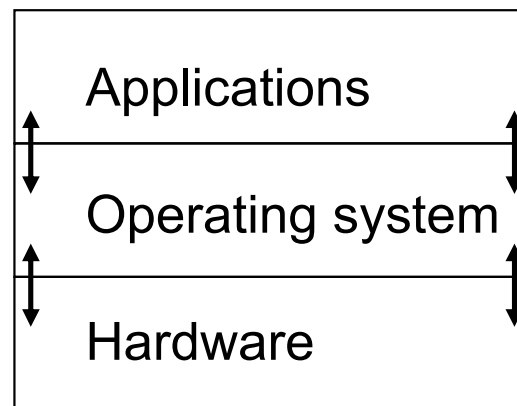
- Harddisk
 - Serves for saving data and programs
 - Persistent memory: data are not lost with a shut down of the computer. Data are only deleted when you explicitly remove them.
 - Data are often organized in so-called files and directories

- Bus-System
 - A bus connects the other five components
 - data are transmitted in form of 0/1-strings
 - consists mainly of some wires plus a controller

Operating System



Basically, the CPU and the devices exchange only 0s and 1s for their communication. Moreover, two different hard disks may use different commands (consisting of 0s and 1s) for the same operation, e.g. for exchanging data between CPU and hard disk. An operating system hides these details from users and application developers.



Well known OS: Windows, Linux, MacOS

- Definition (DIN 44300, translation)

Operating system: Programs of a digital computer system, which build, together with the properties of the system itself, the fundament for the possible operations of the computer system. Especially, these programs operate and monitor the execution of processes.

It covers

- Process management
- File management
- Memory management
- Device management



- Multiuser/Multitasking
- The so-called „Shell“ builds the interface between User and System
- Usually Single-Users which can be grouped
- Private resources / public resources (especially file privileges)
- A lot of utility programs
- Online help
- Inter-process communication is possible

Process Management

The process management controls the resource „CPU“. Roughly spoken, a process is a program, being executed.

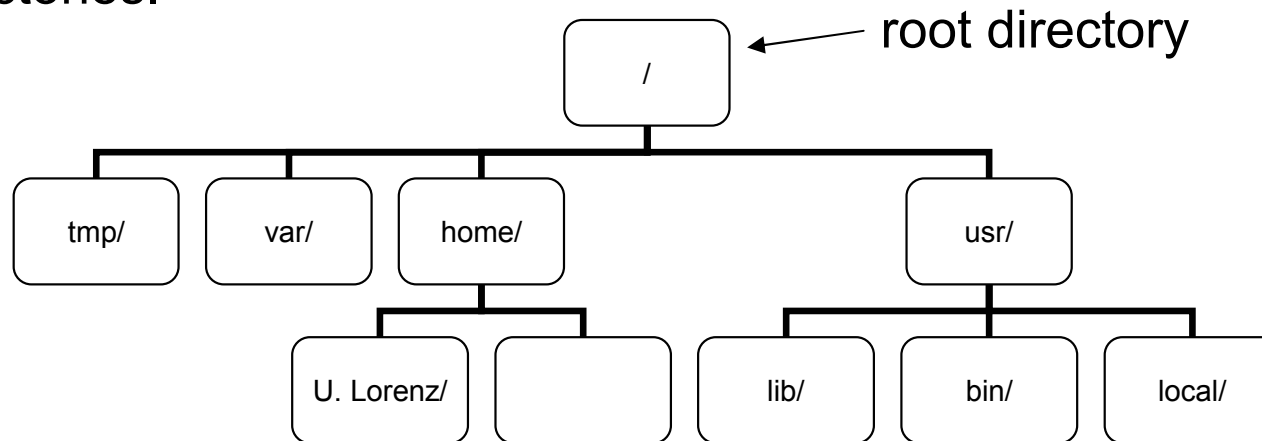
PID

5	state
6	
9	

Each process gets an ID.

File System

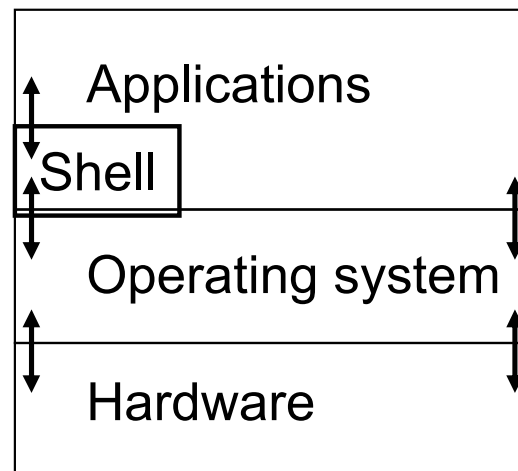
- A file is a sequence of bytes.
- Files are organized in a hierarchy as a tree , with the help of so called directories.



- Structure of other files is unknown to the system. Only defined by user.
- There are only files: devices, directories, ... -- i.e. special files
- A path of a certain file is the path from the root directory to that file:
e.g. Home directory of U. Lorenz: /home/U. Lorenz and path to the file „test.txt“ therein: /home/U. Lorenz/test.txt
- Different files may have the same name in different directories.

Shell

A shell is an interactive program, designed for the man-machine communication. The communication goes via text-commands that are typed in the shell window, and via text output from the machine.



There are commands for:
finding out information about a user, help, finding out the current directory,
listing files and directories, inspecting files, setting your password, modifying
and changing authorizations, copying and moving and removing files, printing ...



going online

Shell Programming



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Different shells (e.g. bash, ksh, tcsh, ash, sh) => different commands/scripts

Why a shell script?

- simple way to string together a bunch of UNIX-commands
- scripts are usually fast to get going
- portable across the whole UNIX world

Nevertheless: scripts are controversial.

- syntax is often ambiguous, wrong documented
- interpretation sometimes leads to surprising results

Helpful webpages:

<http://tldp.org/HOWTO/Bash-Prog-Intro-HOWTO.html>

<http://tldp.org/LDP/abs/html/>

<http://www.google.de>