

Systems Programming in C++

Practical Course

Summer Term 2023

Course Goals

Learn to write **good** C++

- Basic syntax
- Common idioms and best practices

Learn to implement **large systems** with C++

- C++ standard library and Linux ecosystem
- Tools and techniques (building, debugging, etc.)

Learn to write **high-performance** code with C++

- Multithreading and synchronization
- Performance pitfalls

Formal Prerequisites

Knowledge equivalent to the lectures

- Introduction to Informatics 1 (IN0001)
- Fundamentals of Programming (IN0002)
- Fundamentals of Algorithms and Data Structures (IN0007)

Additional formal prerequisites (B.Sc. Informatics)

- Introduction to Computer Architecture (IN0004)
- Basic Principles: Operating Systems and System Software (IN0009)

Additional formal prerequisites (B.Sc. Games Engineering)

- Operating Systems and Hardware oriented Programming for Games (IN0034)

Practical Prerequisites

Practical prerequisites

- **No previous experience with C or C++ required**
- Familiarity with another general-purpose programming language

Operating System

- Working Linux operating system (e.g. recent Ubuntu)
 - Ideally with root access
- Basic experience with Linux (in particular with shell)
- You are free to use your favorite OS, **we only support Linux**
 - Our CI server runs Linux
 - It will run automated tests on your submissions

Lecture & Tutorial

- Lecture: **Tuesday, 12:00 – 14:00, on-site in MI 02.11.018**
- Tutorial: **Friday, 10:00 – 12:00, on-site in MI 02.11.018**
 - Discuss assignments and any questions
 - First **two** tutorials are additional lectures
- Everything will be in English
- **Attendance is mandatory**
- Announcements on the website and on Mattermost

Assignments

- Brief non-coding quizzes in (random) lectures or tutorials
- Weekly programming assignments
 - No teams
 - Managed through our GitLab (more details in first tutorial)
- Final project at end of the semester
 - No teams
 - Managed through our GitLab (more details in first tutorial)
 - More extensive than assignments (several weeks of work)
 - Implementation from scratch (including infrastructure)
 - Lecture will prepare for the project

Topics

Very rough overview of topics

- C++ syntax and language features
- Common C++ programming techniques
- Proper usage of the C++ standard library
- Low-level (performance) considerations
- Systems programming on Linux
- The C++ ecosystem (building, testing, debugging, profiling, ...)
- Keeping control of large projects

Literature

Primary

- Lippman, 2013. *C++ Primer (5th edition)*. Only covers C++11.
- Stroustrup, 2013. *The C++ Programming Language (4th edition)*. Only covers C++11.
- Meyers, 2015. *Effective Modern C++*. 42 specific ways to improve your use of C++11 and C++14..

Supplementary

- Aho, Lam, Sethi & Ullman, 2007. *Compilers. Principles, Techniques & Tools (2nd edition)*.
- Tanenbaum, 2006. *Structured Computer Organization (5th edition)*.

Contact

Important links

- Website: <http://db.in.tum.de/teaching/ss23/c++praktikum>
- E-Mail: riegerm@in.tum.de engelke@in.tum.de lehners@in.tum.de

**Register for the course through the matching platform
(<https://matching.in.tum.de/>)**