Practical Lab
Systems Management and Engineering
(sys-manage)
Preliminary meeting

Chair of Decentralized Systems Engineering
https://dse.in.tum.de/

About this lab

- Organised by Chair of Decentralized Systems Engineering:
  - Website: https://dse.in.tum.de/
  - Location: 1st Floor, 7th Finger
- Instructors:
  - Charalampos Mainas charalampos.mainas@in.tum.de
  - Dr. Masanori Misono masanori.misono@tum.de
  - Prof. Pramod Bhatotia: pramod.bhatotia@in.tum.de
- Other info:
  - Language: English
  - SWS: 6
  - ECTS Credits: 10

Course Topics

- Systems programming
  - Operating systems concepts
  - Application perspective
- Distributed Systems
  - Good understanding of distributed systems architecture
  - Systems perspective
- Systems Administration
  - Cloud infrastructure management:
    - Testbed
    - Kubernetes cluster
- Automation
  - Hands-on experience with github actions
- Testing
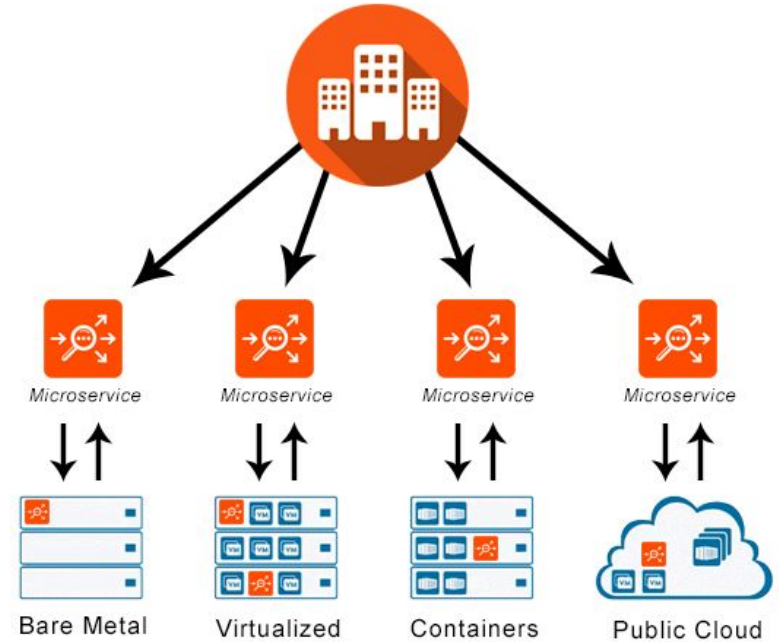 - Assure the correctness of applications
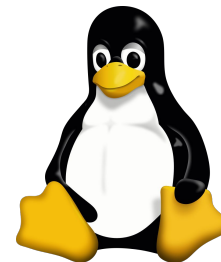
Modern workloads

- Design
  - Microservices
  - Distributed
- Deployment
  - VMs
  - Containers
  - Functions
- Development
  - Automation
  - Different workflow

Monolithic Architecture

App Services

Bare Metal

Microservices Architecture

Microservice   Microservice   Microservice   Microservice

Bare Metal   Virtualized   Containers   Public Cloud

Applications

A cloud infrastructure

- Cloud systems are complex
  - Virtualization layers
  - Runtime libraries
  - Storage systems
  - Network administration
  - Heterogeneity
- A cluster should always be:
  - available
  - secure
  - extensible
  - Energy/Cost efficient
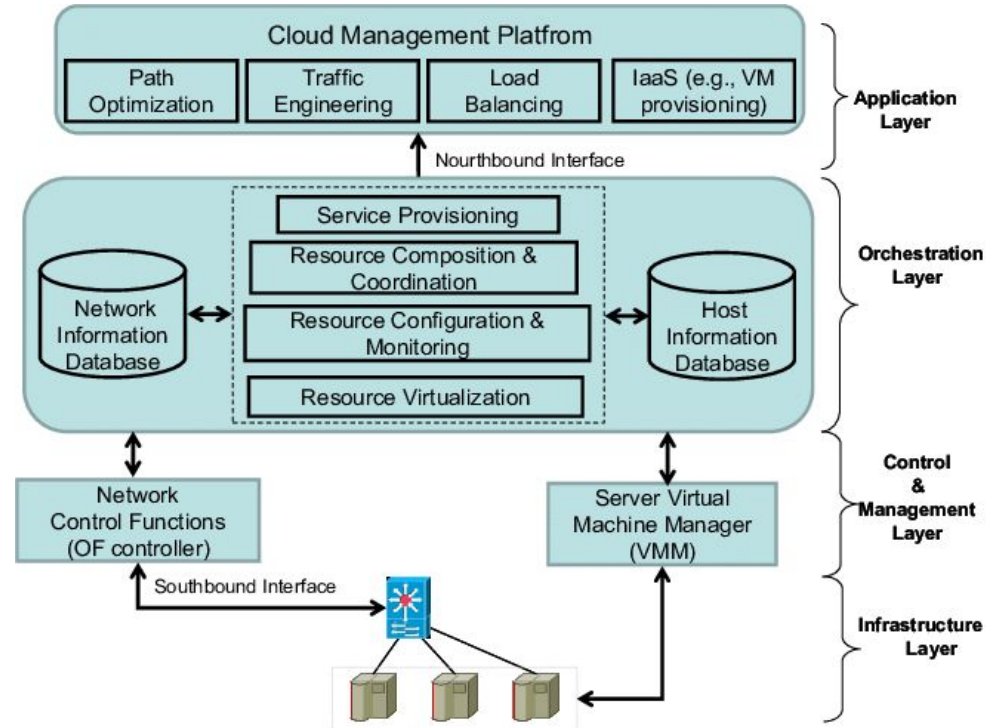
The backbone

- Everything is running on top of an Operating System
  - Libraries and software layers hide the OS
- Basic knowledge of OS fundamentals is necessary for every developer
- Systems engineers need an in-depth understanding
  - Build reliable high performance systems
  - Efficient management of resources
  - Good programming practices
- Systems programs must be reliable
  - If something fails, everything on top of it fails
  - Testing, testing, testing
    - Find all corner cases
    - Automate the process

Learning goals

- Challenge your knowledge in Operating Systems concepts
- Very good understanding of Distributed Systems
- Get familiar with kubernetes (not only as a user)
- Hands-on experience
- Learn to communicate issues across different groups
- An insight of DevOps
- Technical skills:
  - Containers
  - Github actions
  - C/C++, Rust
  - System admin tools

How we gonna achieve our goals

- Our users will be other students
- We will experiment on top of 2 other courses from our Chair
  - Cloud Systems Engineering
    - Focus on distributed systems
    - Students will build a distributed storage system in 4 steps
  - Advanced Systems Programming in C/Rust
    - Focus on OS fundamentals
    - Small exercises on different OS topics (system calls to containers)
- Learn by facing questions and issues raised from other students

Prerequisites

- **Good understanding of Operating Systems concepts**
  - Advanced Systems Programming in C/Rust
  - Systems Programming in C++
- **Familiar with Distributed systems concepts**
  - Introduction to Computer Networking and Distributed Systems
  - Distributed Systems
  - Middleware and Distributed Systems
- **Personal knowledge of above topics from other courses or by yourselves**

In any case, if you are interested, just let us know!

Lab Format

- At total 12 assignments:
  - 8 from sys-prog
  - 4 from cloud-lab
- Each assignment has the following tasks:
  - Q&A
  - Administration of the infrastructure
  - Improvement of test cases
  - Improvement of assignments
- One group of 3 persons will handle each task for the 12 assignments:
  - Everyone will do one of the above tasks at least once.
  - The task will change every week
  - Collaboration

Tasks

- Q&A
    - Interact at slack channel for both courses
    - Resolve issues and questions from other students
    - Propose hints - NOT solutions (Be careful!)
    - Collaborate with other groups (admin group etc for system issue)
- Administration of infrastructure
    - Manage the available hardware resources of the assignment
    - Resolve issues from students
    - Kubernetes installation - maintenance
    - Setup/Update the automation tools

Tasks

- **Assignment improvements:**
  - Collaboration with TAs
  - Propose new exercises
  - Update the existing ones
- **Test cases improvements:**
  - Collaboration with TAs
  - Propose new test-cases
  - Resolve issues regarding testing automation

Grading

- Grades will be assigned according to the contributions.
  - Answer and resolve questions and issues
  - Help setting up the infrastructure
  - Resolve technical problems
  - Improve assignments
  - Add more test cases

The important thing is to learn and test your knowledge, a good grade will follow.

Code of conduct

- University plagiarism policy
  - https://www.in.tum.de/en/current-students/administrative-matters/student-code-of-conduct/

- Decorum
  - Promote freedom of thoughts and open exchange of ideas
  - Cultivate dignity, understanding and mutual respect, and embrace diversity
  - Racism and bullying will not be tolerated

Interested?

Matching platform

Welcome to the Matching platform matching.in.tum.de!

Dear students,

we changed the name of the course "Seminar: Recent advances in Computer Systems", for consistency reasons.
The new name are "Seminar: Hot Topics in Computer Systems", now.
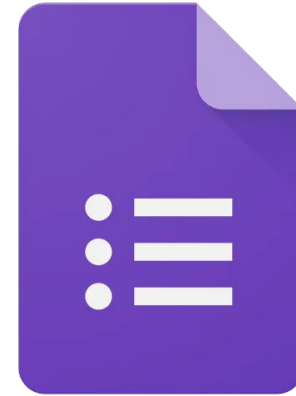
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Any questions? Visit the FAQs!
ⓘ FAQs

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https://wiki.tum.de/pages/viewpage.action?pageId=1046906450
(Link available in TUM online)

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Website: https://dse.in.tum.de/

Channel: #ss-22-sys-manage

Join us with TUM email address (@tum.de)