Chair of Connected Mobility
TUM School of Computation, Information and Technology
Technische Universität München

WS 2024/25
Master Practical Course: Computer Network Simulation

Pre-Meeting
09.07.2024

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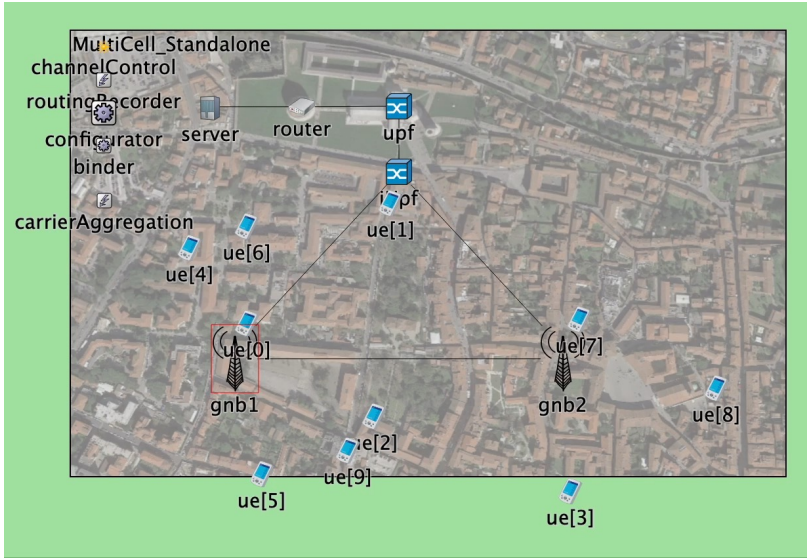
What is a Simulation?

In most basic terms

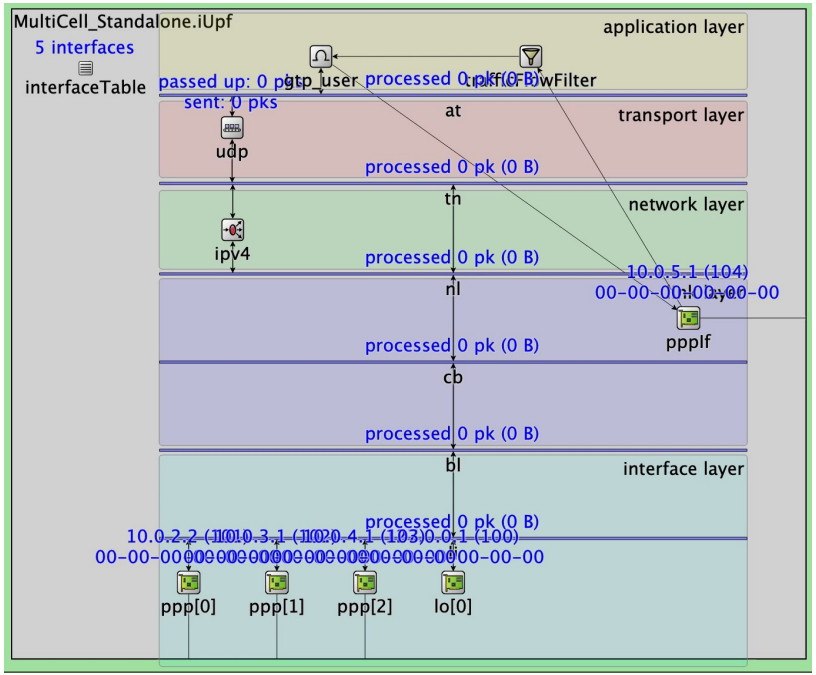
→ “imitation of a real-world process or system”



Advantages

- Less Financial Risk (avoid costly mistakes)
- Gain Insights on System Behaviour
- Test Non-Standard Situations
- Examine Long-Term Impacts

Why do we use network simulation?

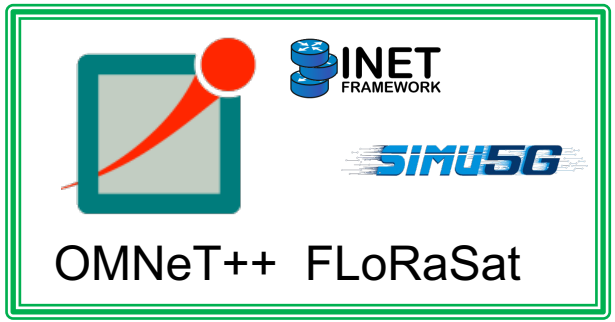


- Testing and prototyping for new ideas
- Experimentation when it's infeasible to build new network infrastructure
- Verification of things that cannot be run in a testbed environment
- Method for rapid prototyping

Available Network Simulators

The ONE

NextGSim



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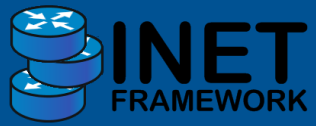
[emulator]

Focus of the Course (Study Goals)



FLoRaSat

- Understand the usefulness of the simulation in the computer networking field
- Learn how to operate simulator software and extend it on the example of OMNeT++
- Learn how to obtain and visualize meaningful results
- Learn cutting-edge networking technologies
- Understand the limitations of simulation

Course Contents
Networking Technologies

- General Computer Networking Recap
- Various Networked Applications
- 5th Generation Mobile Networks (5G)
- Edge Computing
- Time-Sensitive Networking (TSN)
- LEO Constellation Satellite Communication

Structure of the Course

~5 weeks of lectures covering

- Introduction to Simulation Environment
- Computer Networking Recap
- Introduction of Relevant Technologies [Edge Computing, 5G, TSN, etc.]
- **Three graded individual homework and feedback discussion sessions!**

~10 weeks of project work in groups of 3 people

- You can choose your project out of our suggestions or propose your own
- Use OMNeT++ and custom modules implemented by you to simulate a complex network
- Provide visualized results covering various metrics
- **Three mandatory presentations**
  - **Initial project meeting and discussion**
  - **Mid-term project meeting and discussion**
  - **Final project presentation**

Structure of the Course

- Five Lecture Weeks
- ~Ten Weeks of Project Work

Week 1 (25.10.2024)	Week 2 (01.11.2024)	Week 3 (08.11.2024)	Week 4 (15.11.2024)
Lecture – Introduction to Discrete Event Simulation and OMNeT++ Simulator A hands-on exercise with OMNeT++ First homework handout (2 weeks, submission 07.11.2024)	No lecture due to holiday	Lecture – Computer Networking Recap and Introduction to the INET Framework First Homework Discussion and Feedback Second homework handout (2 weeks, submission 21.11.2024)	Lecture – 5th Generation Mobile Networks and Introduction to the Simu5G Framework Lecture – Introduction into 5G Radio Lecture – Introduction to Advanced Networking Concepts

Timeline subject to change

Structure of the Course

- Five Lecture Weeks
- ~Ten Weeks of Project Work

Week 5 (22.11.2024)	Week 6 (06.12.2024)	Week 10/11 (~17.01.2025)	Week 15 (07.02.2025)
Lecture – Excursion on Time-Sensitive Networking Lecture – Excursion on LEO Constellations Second Homework Discussion and Feedback Third homework handout (1 week, submission 28.11.2024)	Third Homework Discussion and Feedback Initial project meeting and discussion	Mid-term project meeting and discussion	Final project presentations

Timeline subject to change

Project Work

Use OMNeT++ as a simulation tool to implement and validate a networking concept

→ Implement a new/enhanced concept into OMNeT++

Your testing environment and application must include

- Custom modules implemented by you
- Mobility of users and wireless networks (5G
- Automatic execution and processing pipeline
- Multiple distinct experimentation scenarios

You can choose your topic!

We will offer specific topics you can work on

You can propose your own topics

Project Work
And Grading

Total of **100 points**

30 points for homework assignments

70 points for the project assignment

- **2 points** → initial presentation
- **3 points** → mid presentation
- **10 points** → final presentation
- **10 points** → final report
- **45 points** → implementation, including demo and idea realization

Projects done in groups of 3 students

Your project submission will cover

- 3 presentations
- code
- final report

Course Registration

Registration using the matching system

- Duration: **12.07.2024 – 16.07.2024**

To increase your chances, please send us your CV and a short motivation letter!

- Email: bosk@in.tum.de
  mehmetmert.bese@tum.de
- Always address your messages to both emails!

In Case of Acceptance

- We will contact you between 25.07.2024 and 09.08.2024 with more information
- Course deregistration possible until 30.09.2024
- **You will get a failing grade for the course if you get a place and not deregister!**
- We will register you for the course in TUMOnline in the beginning of October

Thanks for attending!
Any questions?

Feel free to contact us!

Marcin – bosk@in.tum.de

Mert – mehmetmert.bese@tum.de