Master Practical Course: Computer Networks Simulation

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What is a Simulation?

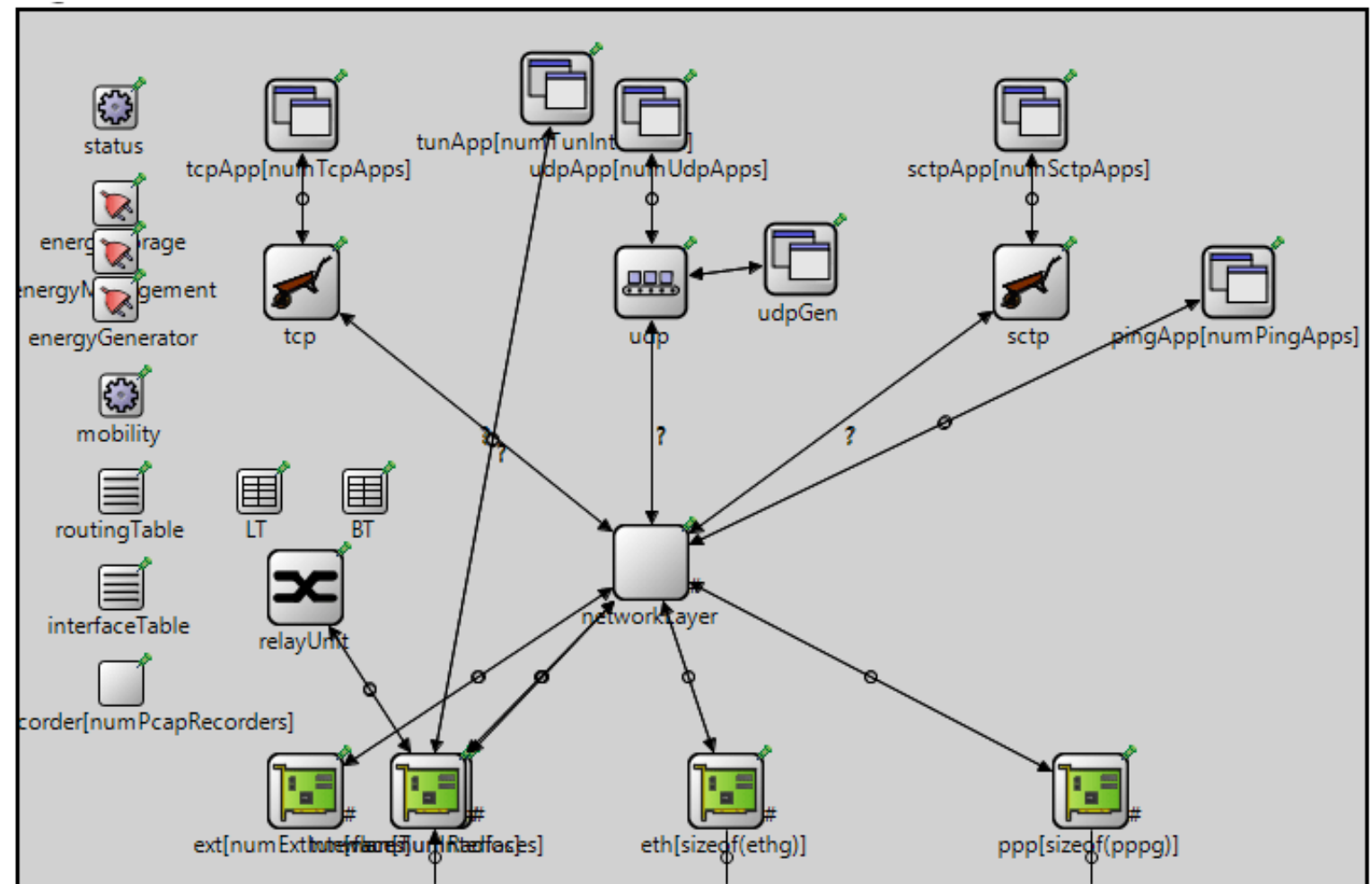In most basic terms, "imitation of a real-world process or system"

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?

Infeasible to build a new network infrastructure.

Testbeds may not be enough

Fast prototyping

Source: https://www.researchgate.net/figure/Figure-6-A-framework-for-OMNeT-with-INET-To-measure-the-performance-of-the-present_fig2_329018404

Available Network Simulators

Ns3

OMNeT++

Simulink

OPNET

NetSim

GloMoSim

Mininet [emulator]

And many more…

Course Contents - Networking Technologies

General Computer Networking Recap

Video Streaming Applications

Edge Computing

Time-Sensitive Networking (TSN)

5th Generation Mobile Networks (5G)

Focus of the Course (Study Goals)

Understand the usefulness of the simulation in the computer networking field

Learn how to operate a simulator software (OMNeT++) and extend it

Learn how to obtain and visualise meaningful results

Learn cutting-edge networking technologies

Understand the limitations of simulation

Structure of the Course

3 - 4 weeks of lectures

• Computer Networking Recap

• Introduction of Relevant Technologies [Edge Computing, 5G, TSN, etc.]

• Introduction to Simulation Environment

10 weeks with 5 graded assignments

Assignments & Course Grading

5 Graded Assignments (20% each) with:

- A task to solve using the simulator (50%)

- A report to write on the task (30%) including:

  - Overcome challenges

  - Technical details on the solution

  - Operational instructions

  - Obtained, visualised, and evaluated results

- Feedback Talk (20%)

The grading details in brackets subject to change!

Tentative Assignment Topics

- Implementation of a new application into the simulator
  - E.g. a simple video streaming application
  - Details TBD

- Definition and implementation of evaluation methods for data obtained from simulation
  - Prepare a pipeline for result evaluation and learn how to make good plots

- Edge Computing
  - Details TBS

- 5G
  - Details TBD

- TSN / V2X (subject to change)
  - Subject to change
  - Details TBD

Schedule (Tentative)

21.10.22 - 1st Lecture

28.10.22 - 2nd Lecture

04.11.22 - 3rd Lecture -> possibly additional Assignment 0 for familiarisation with simulation

11.11.22 - 4th Lecture -> give out first assignment (deadline 27.11.22 23:59)

18.11.22 - Possibly Discussion on Assignment 0 & Q&A

25.11.22 NO MEETING -> give out second assignment (deadline 11.12.22 23:59)

02.12.22 - Feedback/Discussion round on Assignment 1

09.12.22 NO MEETING -> give out third assignment (deadline 23/25.12.22 23:59)

16.12.22 - Feedback/Discussion round on Assignment 2

23.12.22 NO MEETING -> give out fourth assignment (or on 09.01.23) (deadline 22.01.23 23:59)

30.12.22 NO MEETING (Christmas break)

06.01.23 NO MEETING (Christmas break)

13.01.23 - Feedback/Discussion round on Assignment 3

20.01.23 NO MEETING -> give out fifth assignment (deadline 05.02.23 23:59)

27.01.23 - Feedback/Discussion round on Assignment 4

03.02.23 NO MEETING

10.02.23 - Final session. Feedback/Discussion round on Assignment 5

Thanks for attending. Any questions ?