RoboLab Real-time Rescue

TDDD07 labs

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Agenda

- Lab goals and scenario

- Lab environment

- Assignments

- Passing requirements

- Practical issues

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Lab goals and scenario

Lab goals

- Hands-on experience with a real-time system

- Learn how to:
    - Schedule real-time tasks
    - Schedule communication on a constrained channel

- Train ability to present and document solutions

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Scenario

- Search and rescue
- Teams of cooperating robots

Video

https://www.youtube.com/watch?v=FrgEbx6esYE

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Lab environment

RoboLab room

Closed area

Victim

Student workstations running the **mission control** software

Robot with laptop running the **robot agent** software

Wifi access point

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Localisation

cover
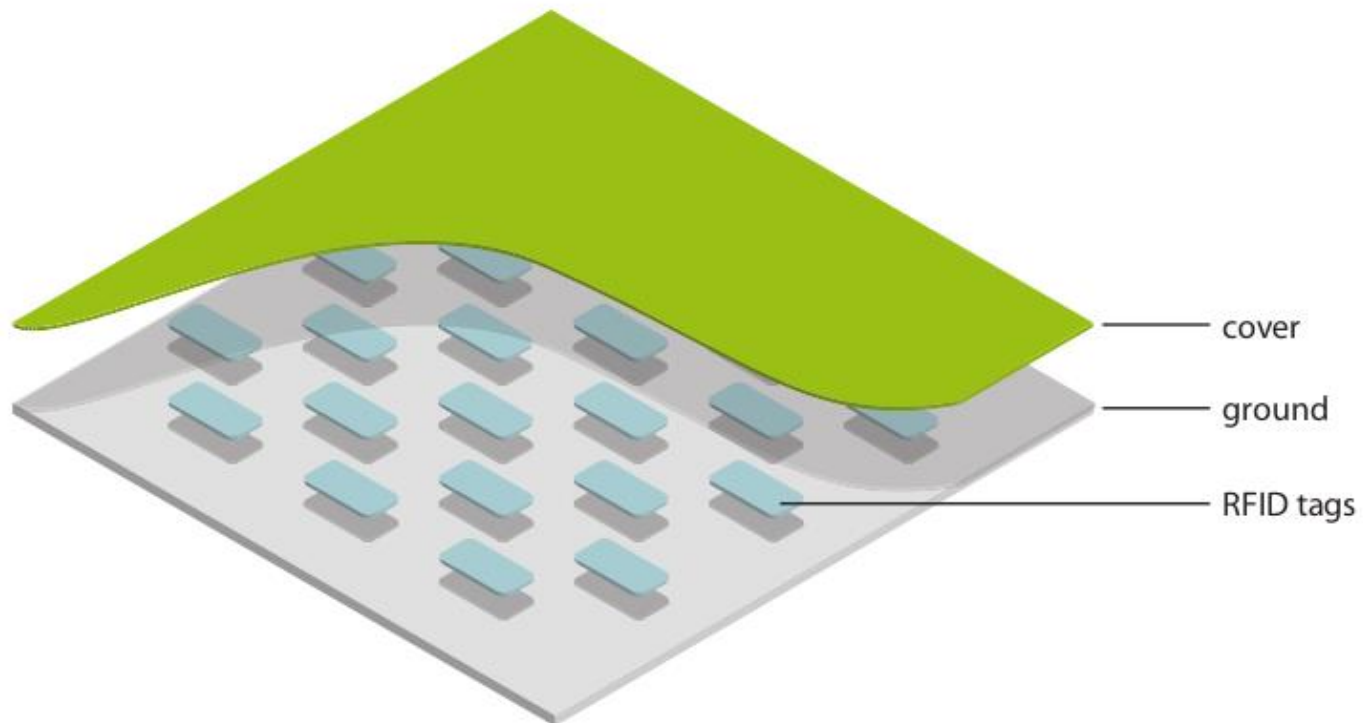
ground

RFID tags
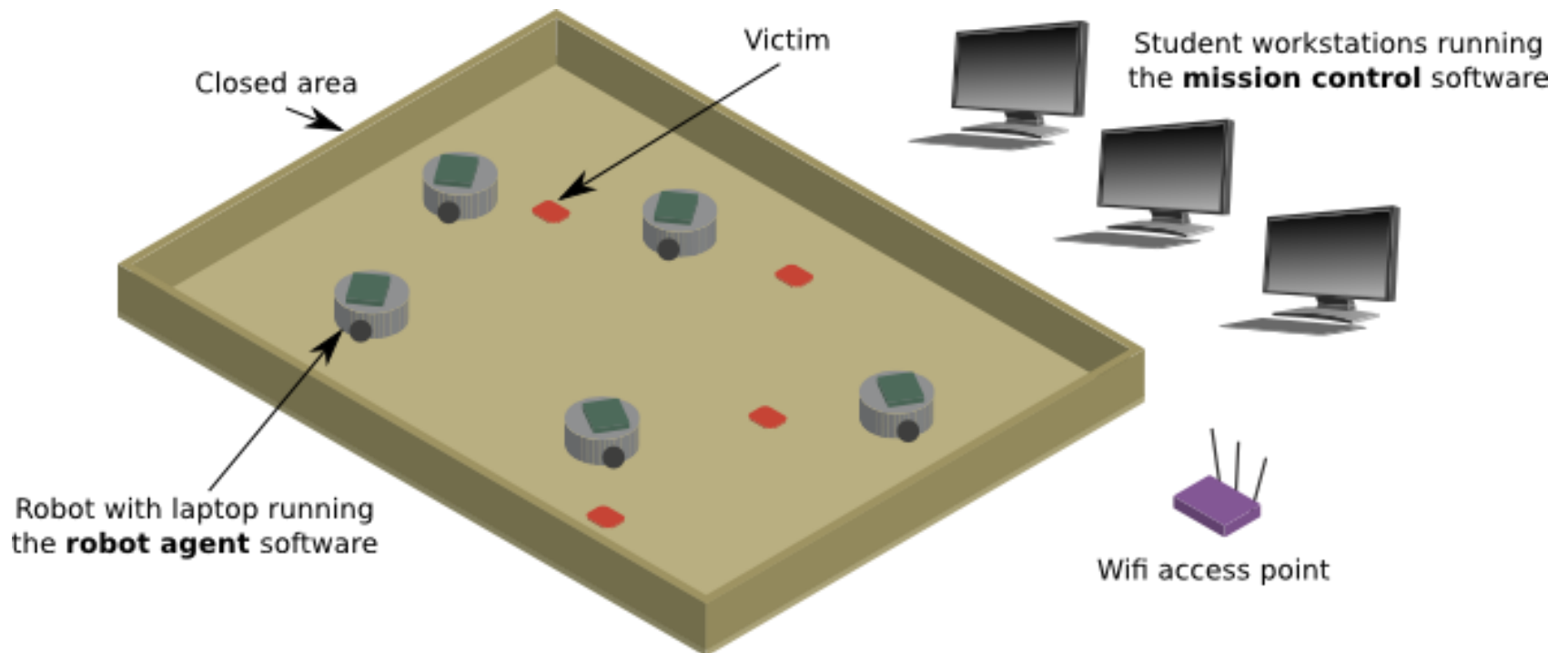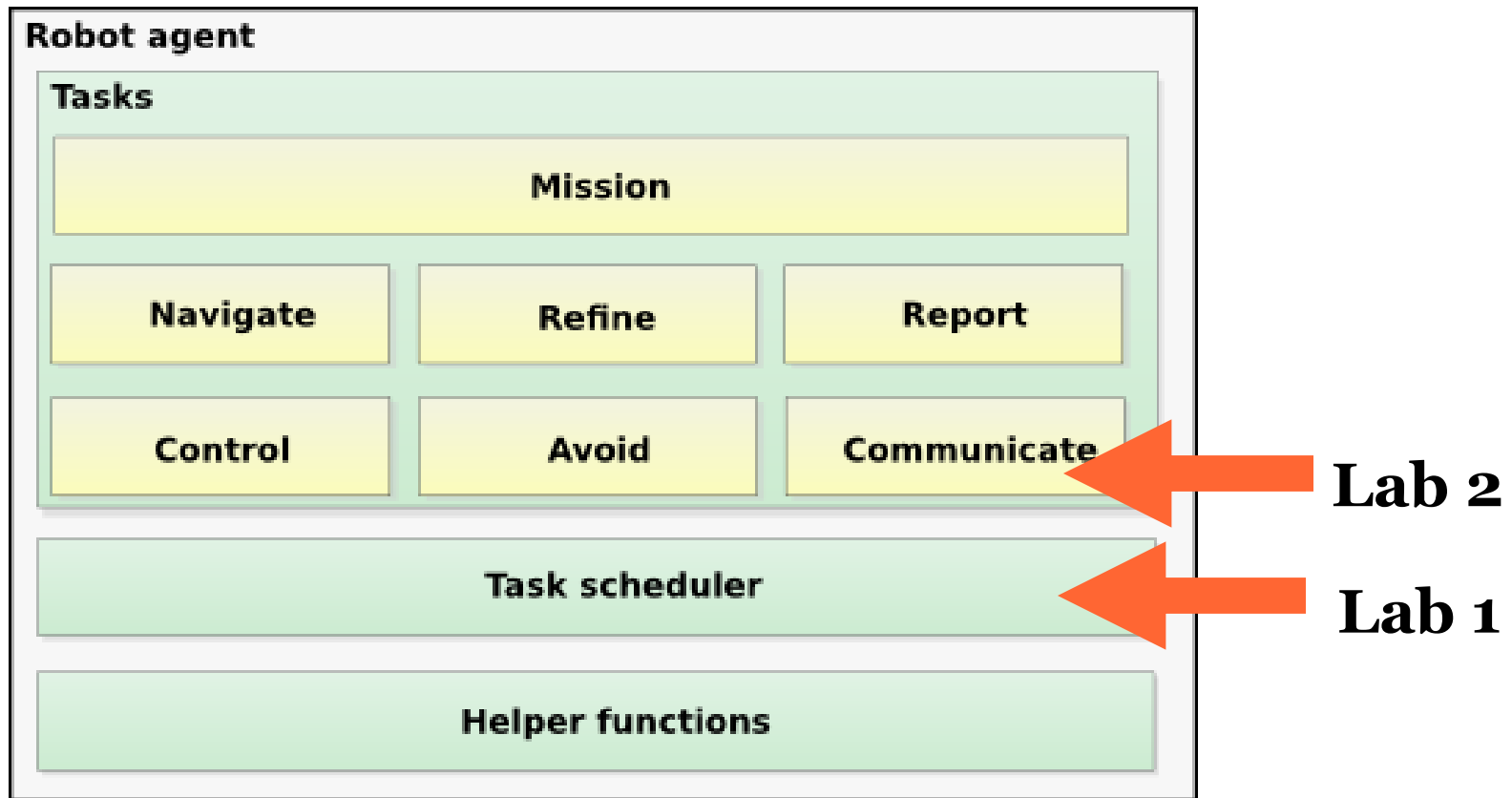
Robot agent overview

- Written in C

- Runs on Raspberry Pi

- Single process, multiple tasks
  - Internally scheduled
  - Straightforward implementation
  - No preemption

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# Robot agent architecture

Assignments

Overview

- Lab 1
  - Analyze real-time properties and design a schedule
- Lab 2
  - Enable real-time communication on a shared channel
- Lab 3 *(gives bonus points for the exam)*
  - Analyze and implement fault tolerance

Lab 1 assignments

- Estimate the tasks' worst case execution time (WCET)

- Determine the minimum and maximum acceptable periods

- Design and implement a schedule

- Evaluate

Lab 2 overview

- Shared communication channel
- One slot for each robot (TDMA-like)
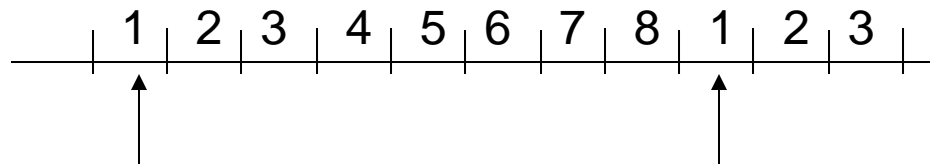
- Server sends "go ahead" if transmissions are correct
- Robots stop unless go ahead is received

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Lab 2 assignments

- Make the communication task run in the pre-defined time slot

- Prioritize messages and send only those that fit in the slot

- Test your solution together with one or more other robots

- Evaluate

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Lab 3 assignments

- Identify fault models

- Suggest mechanisms to detect and manage the faults

- Implement them

Passing requirements

Overview

- Lab 1
  - preparatory questions
  - demonstration
  - code submission
- Lab 2
  - preparatory questions
  - demonstration
  - code submission
- Lab report
- Lab 3 is evaluated by a separate individual report

Preparatory questions

- Read the compendium!

- Separate questions for labs 1 and 2

- Answer preparatory questions before the labs

- Send to your lab assistant at least **3 hours before** the lab session

- The lab assistant will reply with the required information to be able to start the system

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Demonstration

- Present your solution to the lab assistant

- Answer some questions

- All members of a lab group should be able to do the whole demonstration individually

- Assessment is individual

- Ask your assistant for demonstration when you are ready (starting from the second lab session)

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Reminder of some rules

- **It is not allowed to hand in solutions copied from other students, or from elsewhere**, even if you make changes to the solutions. If there is suspicion of such, or any other form of cheating, teachers are obliged to report it to the University Disciplinary Board.

- **Be prepared to answer questions about details in specific code** and its connection to theory. You may also be asked to explain why you have chosen a specific solution. This applies to all group members.

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Lab report

- Read the compendium for report requirements
  - All the points have to be covered in order to pass!

- Use the spellchecker!
  - Any report obviously not spellchecked will be sent back directly

- Proper structure and consistent formatting

Deadlines

- Demonstration: **2024-12-16 (last lab session)**

- Report and source code hand-in: **2024-12-17**

- Lab assistant gives comments by **2025-01-03**, you have **one opportunity** to hand in corrections. Expect to have some corrections to make.

- Corrected version: **2025-01-10**

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Practical issues

Lab registration

- If you did not sign up on Webreg, talk to me

- Room: close to SU01 (map on next slide)

- Please attend the labs
  - Access to robots only during scheduled hours

- Be careful with the equipment
- Keep the room in order

Find the Robolab room

Extra lab sessions

- Possible to get extra unsupervised time in the lab room on the slots (LA reserve, see timetable). There will be no group B this year!

- Only on request, send an email to your lab assistant latest the day before the session you wish to attend (before 17.00).

- Be on time!

- When entering, write your LiU ID on the whiteboard.

- When you leave, strike it through (do not erase it!).

- The last person leaving the room writes an email to the responsible course assistant (the name will be on the whiteboard).
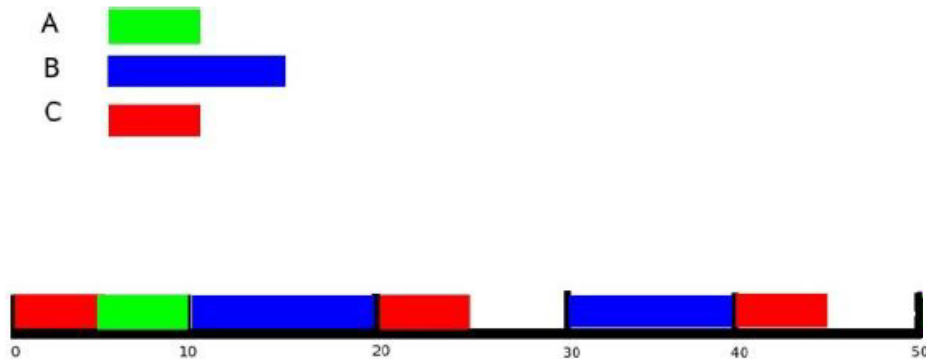
Extra lab time for lab 3

- For implementing the lab 3 solution, you can get on-demand access to the lab room in December. Contact your lab assistant.

- You need to book a slot with your lab assistant for demonstration of lab 3

- Deadline for lab 3 demonstration is **2024-12-16**
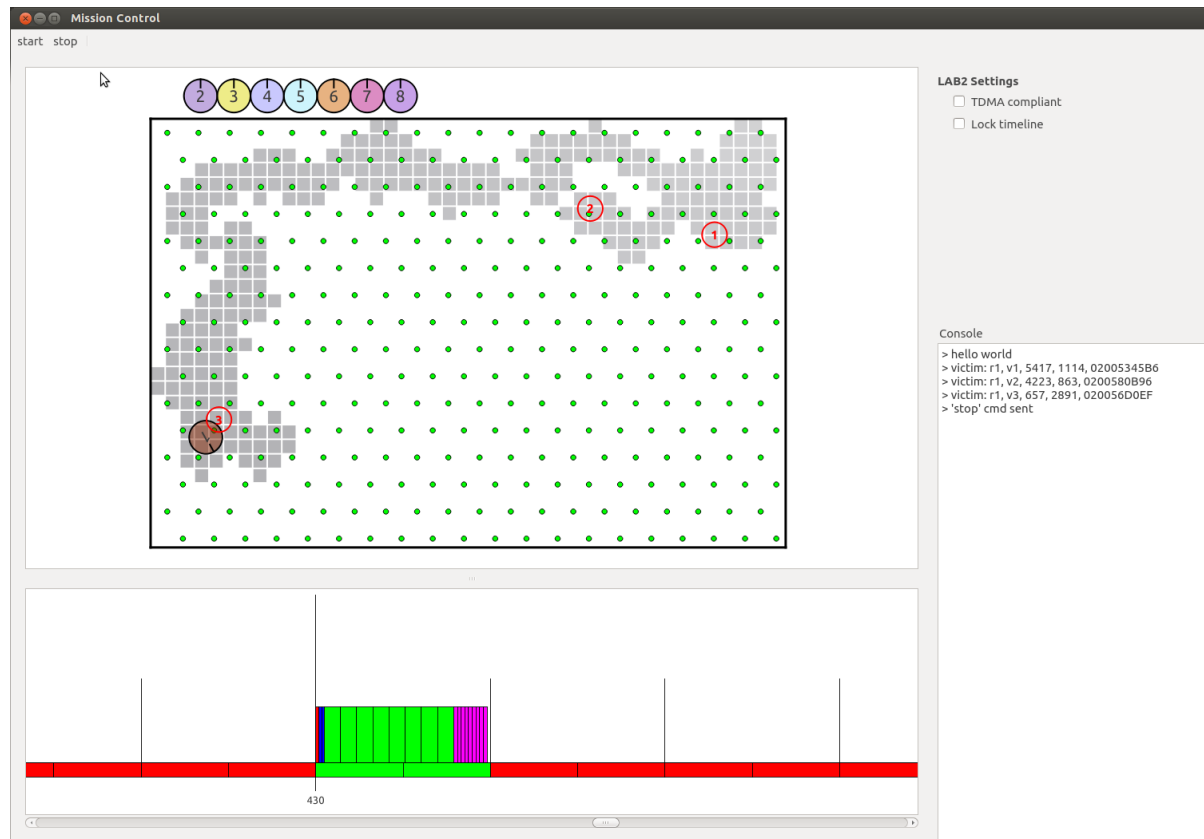
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Submitting solutions

- Two addresses for each lab assistant, see web page!
- Format for email subject:
  - "TDDD07, Group X, Y for lab Z"
  - X = [A|B|C][1-6]
  - Y = {preparatory questions, code, question}
  - Z = {1,2,3}

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Presenting a cyclic schedule

- Better with a graphical visualization than text only
- Example:

A guide to the GUI

Packets

Packets:
* Red: victim reports
* Blue: location messages
* Green: pheromone maps
* Magenta: stream data

430

Robot location message received

All packets received within timeslot

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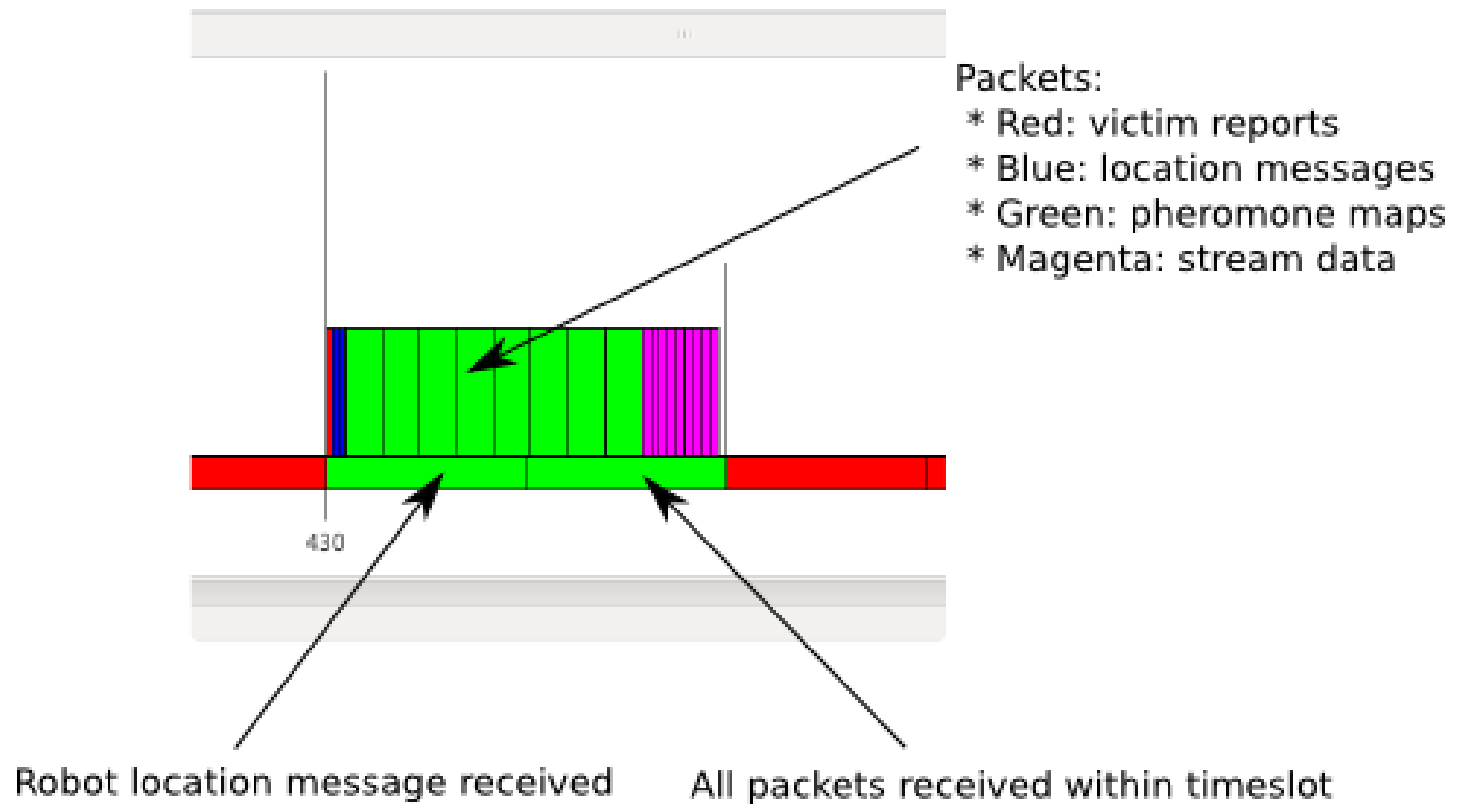
Final notes

- Prepare!

- Investigate!

- Have fun!

http://www.ida.liu.se/~TDDD07/

www.liu.se