

# RoboLab Real-time Rescue

TDDD07 labs

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# Agenda

- Lab goals and scenario
- Lab environment
- Assignments
- Passing requirements
- Practical issues

# 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

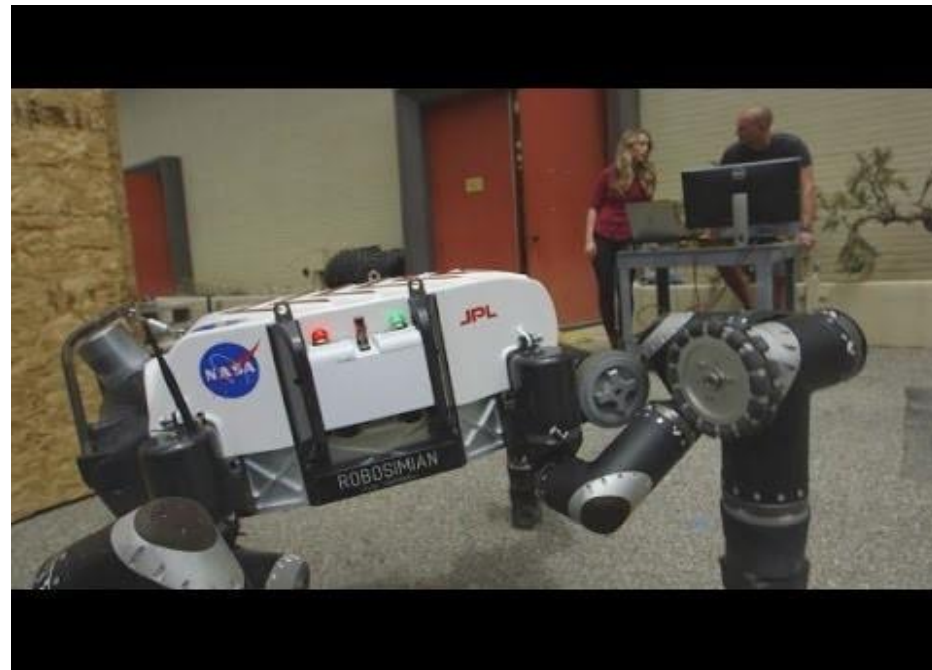
# Scenario

- Search and rescue
- Teams of cooperating robots



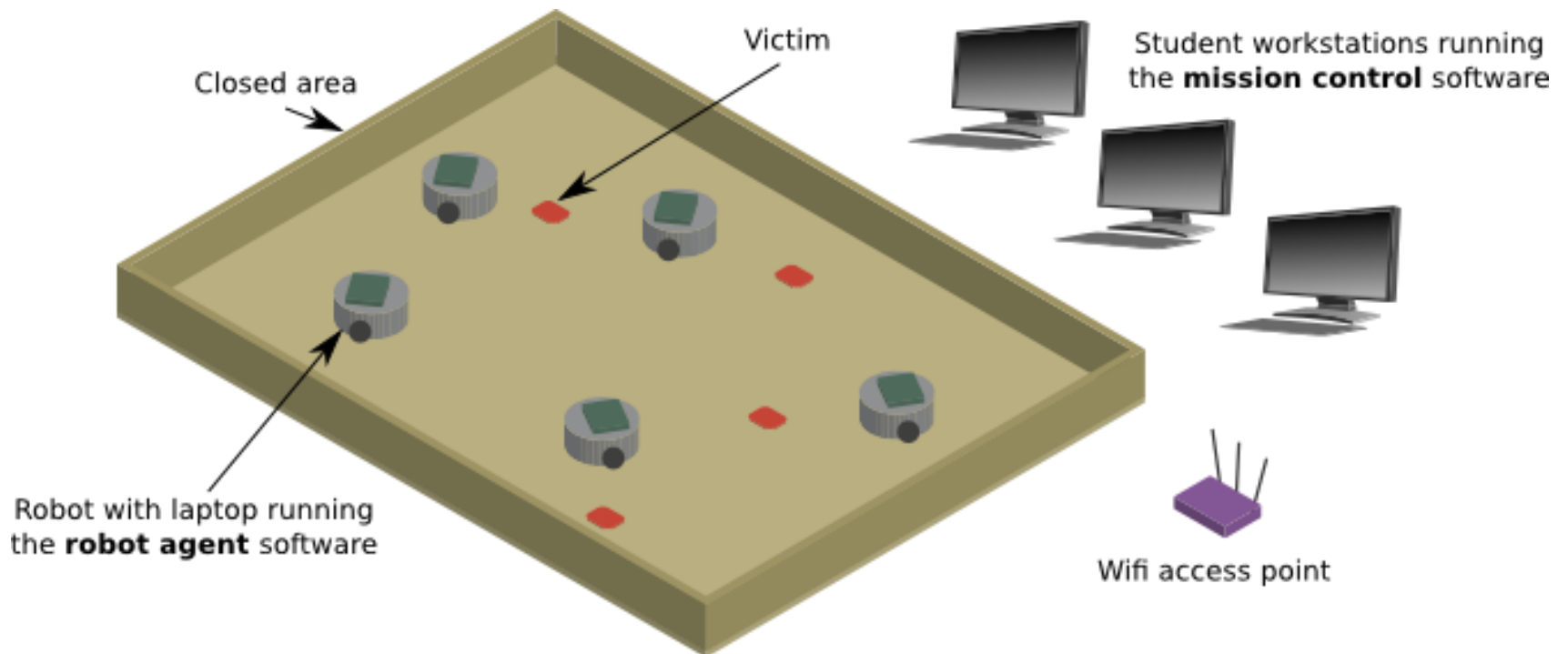
# Video

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



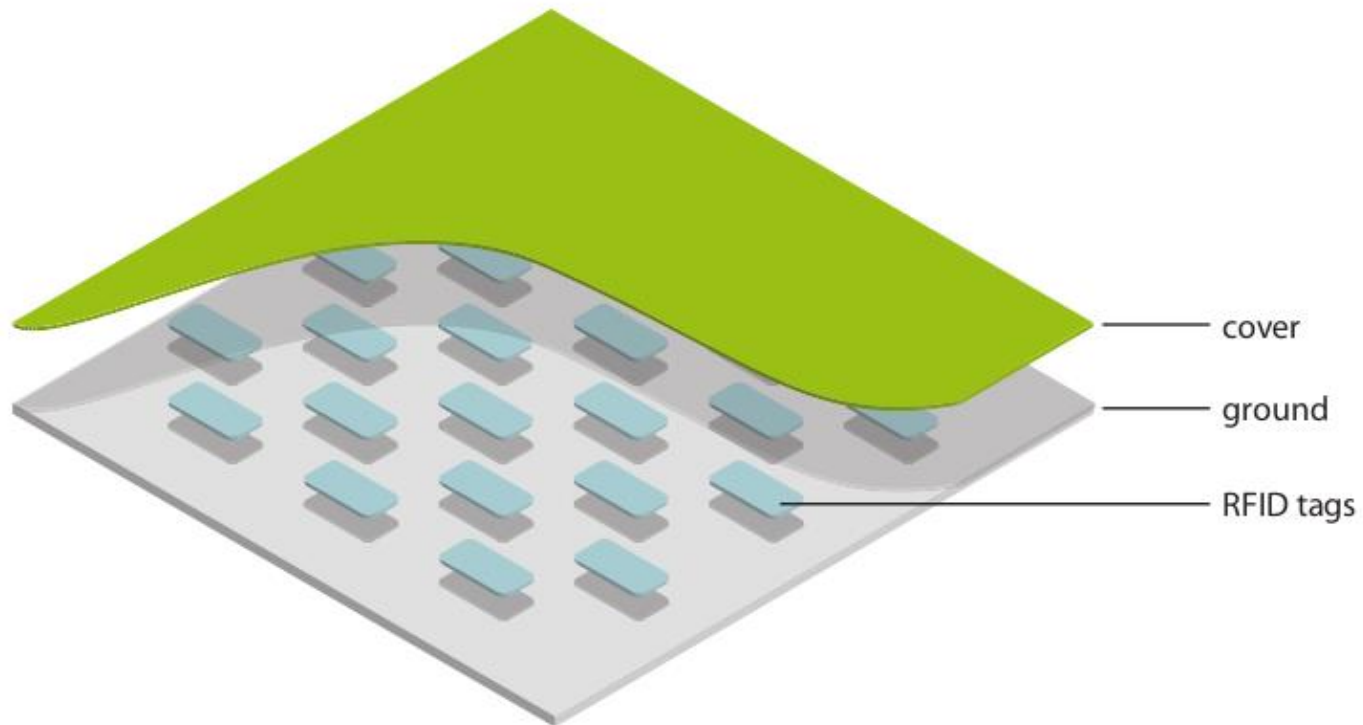
# Lab environment

# RoboLab room





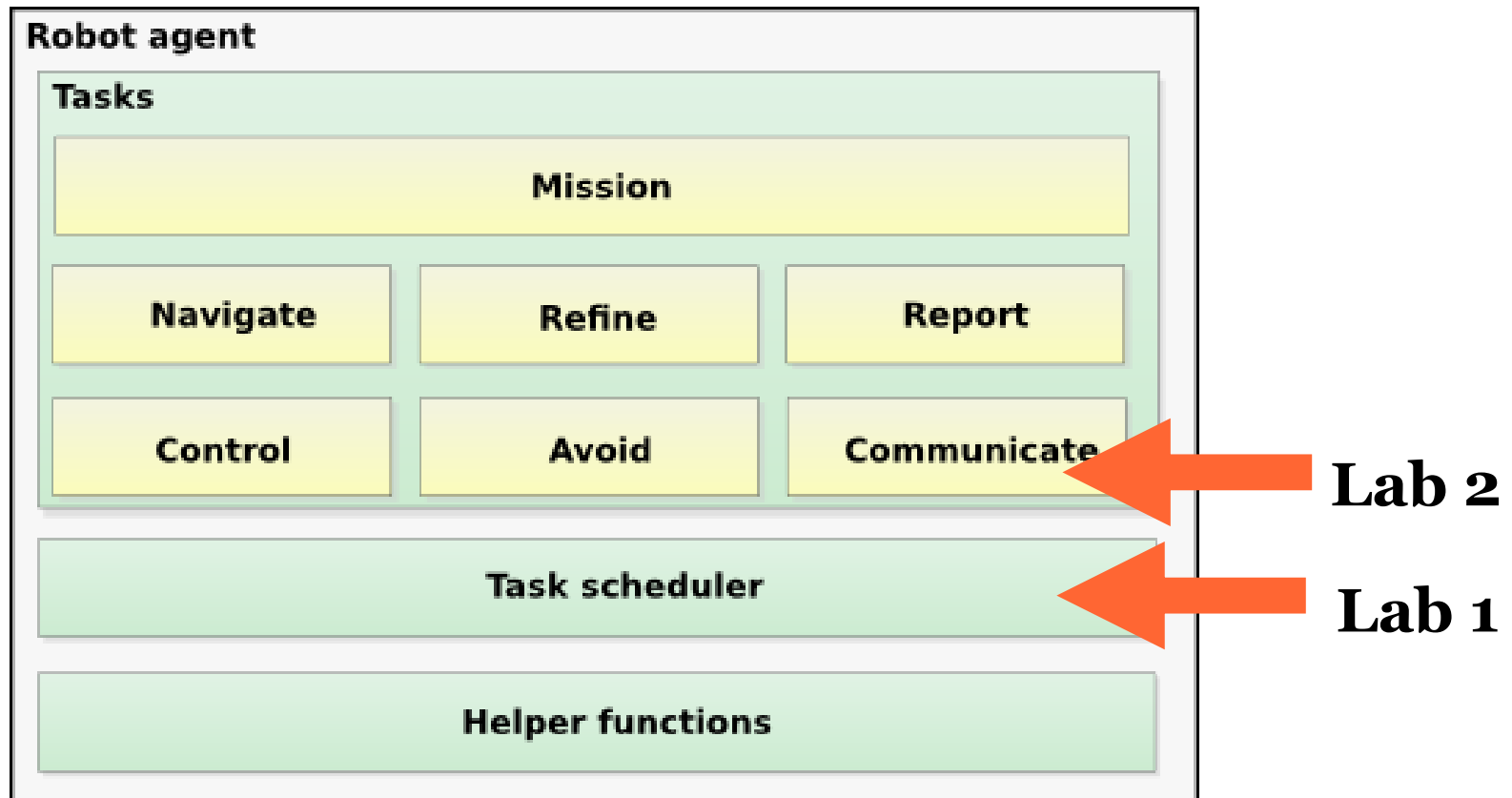
# Localisation



# Robot agent overview

- Written in C
- Runs on Raspberry Pi
- Single process, multiple tasks
  - Internally scheduled
  - Straightforward implementation
  - No preemption

# Robot agent architecture



# Assignments

# Overview

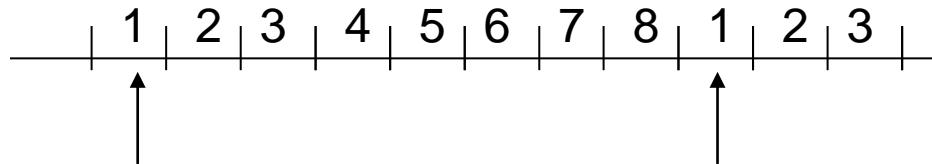
- Lab 1
  - Analyze real-time properties and design a schedule
- Lab 2
  - Enable real-time communication on a shared channel
- Lab 3 (*gives bonus points for the exam*)
  - Analyze and implement fault tolerance

# Lab 1 assignments

- Estimate the tasks' worst case execution time (WCET)
- Determine the minimum and maximum acceptable periods
- Design 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

## 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



# 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

# 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)

## 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.

# 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: **2021-12-13 (last lab session)**
- Report and source code hand-in: **2021-12-15**
- Lab assistant gives comments by **2022-01-07**, you have **one opportunity** to hand in corrections. Expect to have some corrections to make.
- Corrected version: **2022-01-14**



# Practical issues

# Lab registration

- If you did not sign up on Webreg, talk to me
  - Room: close to SU01
  - Please attend the labs
    - Access to robots only during scheduled hours
  - Be careful with the equipment
  - Keep the room in order
-

## Extra lab time for lab 3

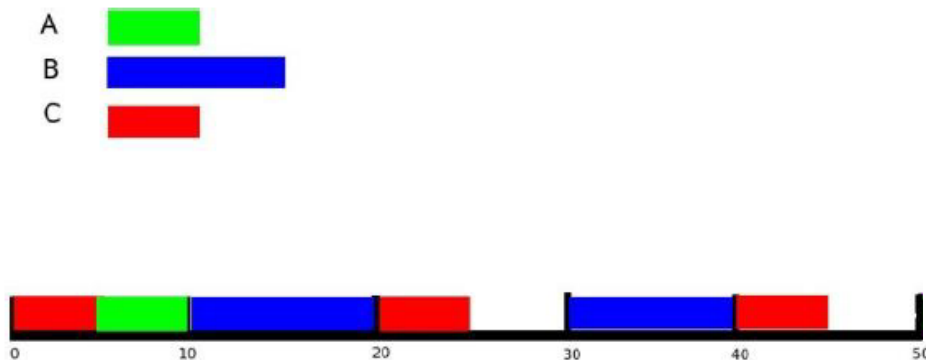
- For implementing the lab 3 solution, you can get on-demand access to the lab room in December. Contact your lab assistant.
- You need to book a slot with your lab assistant for demonstration of lab 3
- Deadline for lab 3 demonstration is **2021-12-16**

# Submitting solutions

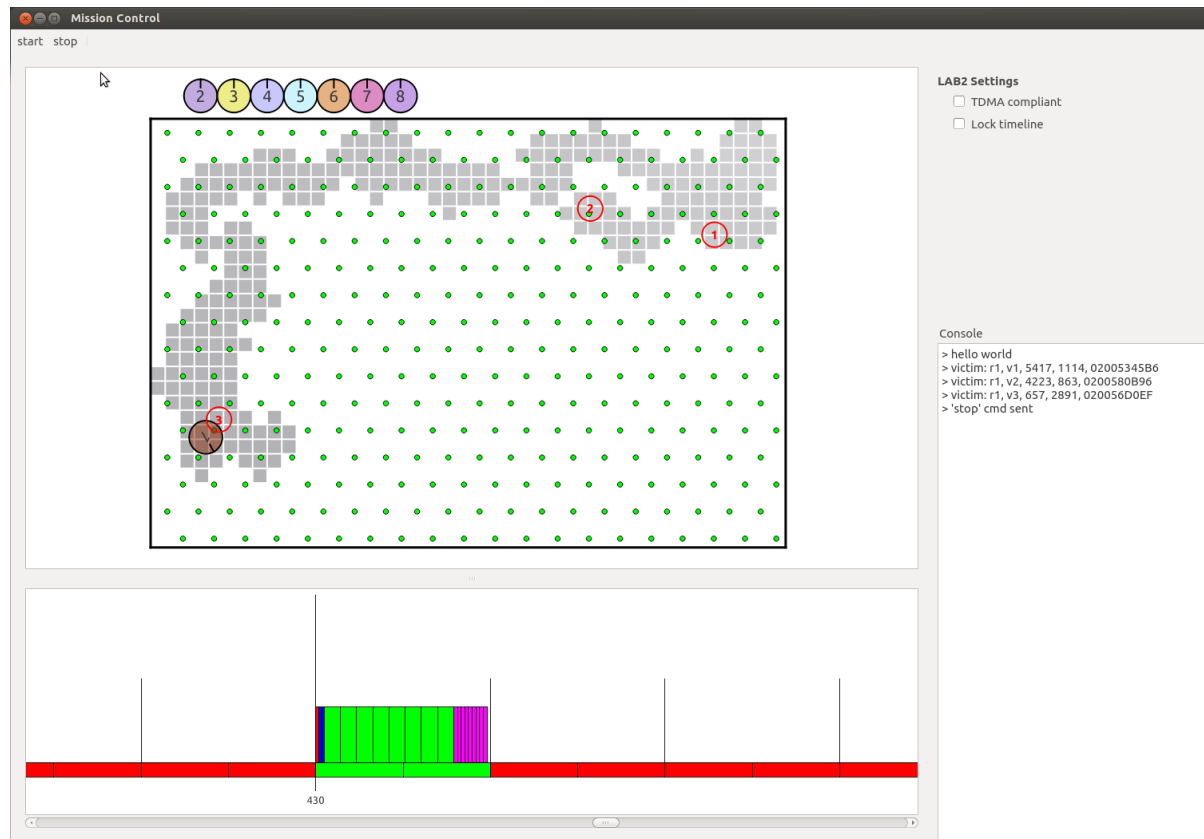
- Two addresses for each lab assistant, see web page!
- Format for email subject:
  - "TDDDo7, Group X, Y for lab Z"
  - $X = [A|B|C][1-6]$
  - $Y = \{\text{preparatory questions, code, question}\}$
  - $Z = \{1,2,3\}$

# Presenting a cyclic schedule

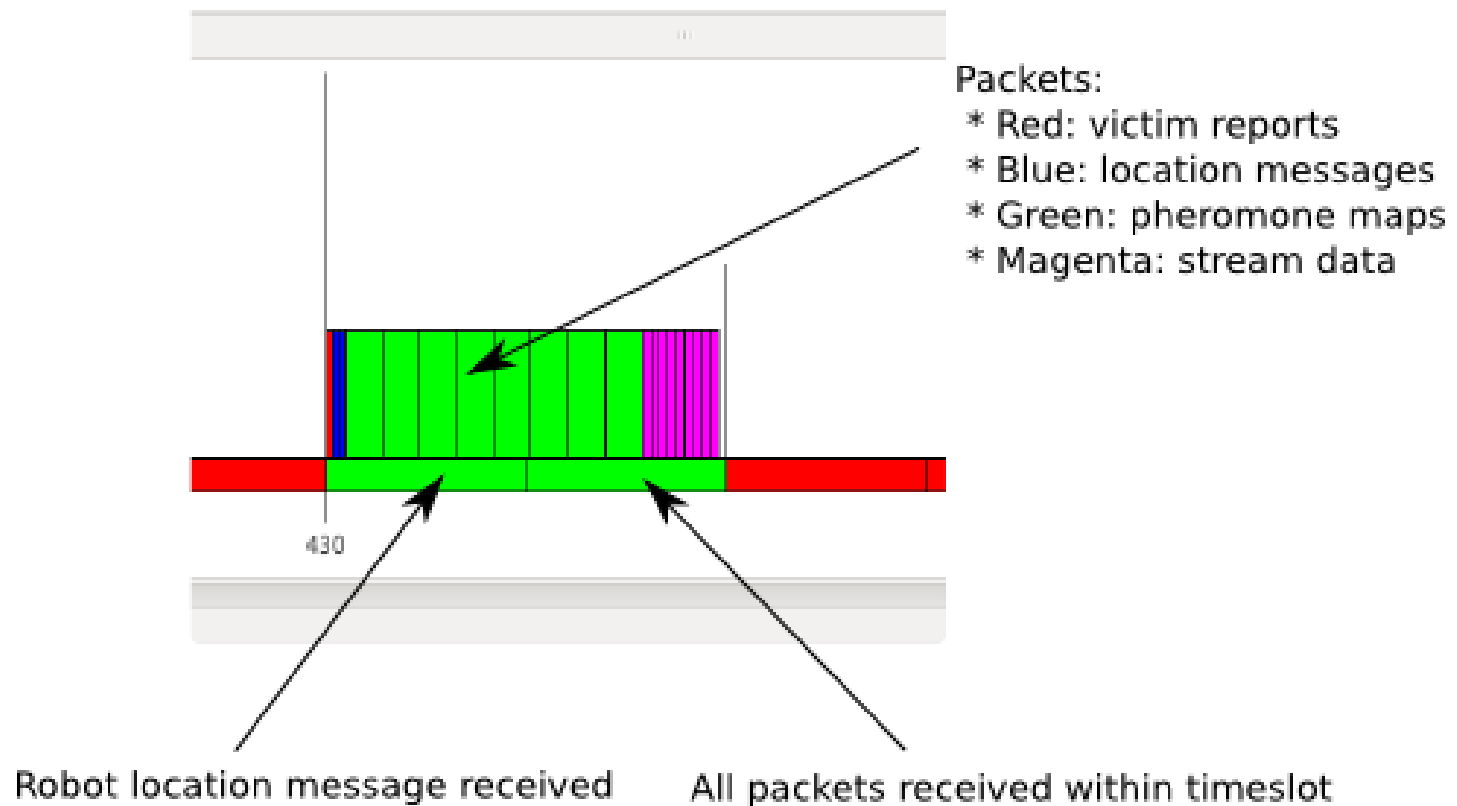
- Better with a graphical visualization than text only
- Example:



# A guide to the GUI



# Packets



# Final notes

- Prepare!
- Investigate!
- Have fun!



<http://www.ida.liu.se/~TDDDD07/>

[www.liu.se](http://www.liu.se)