Robot - Software architectures for robot programming
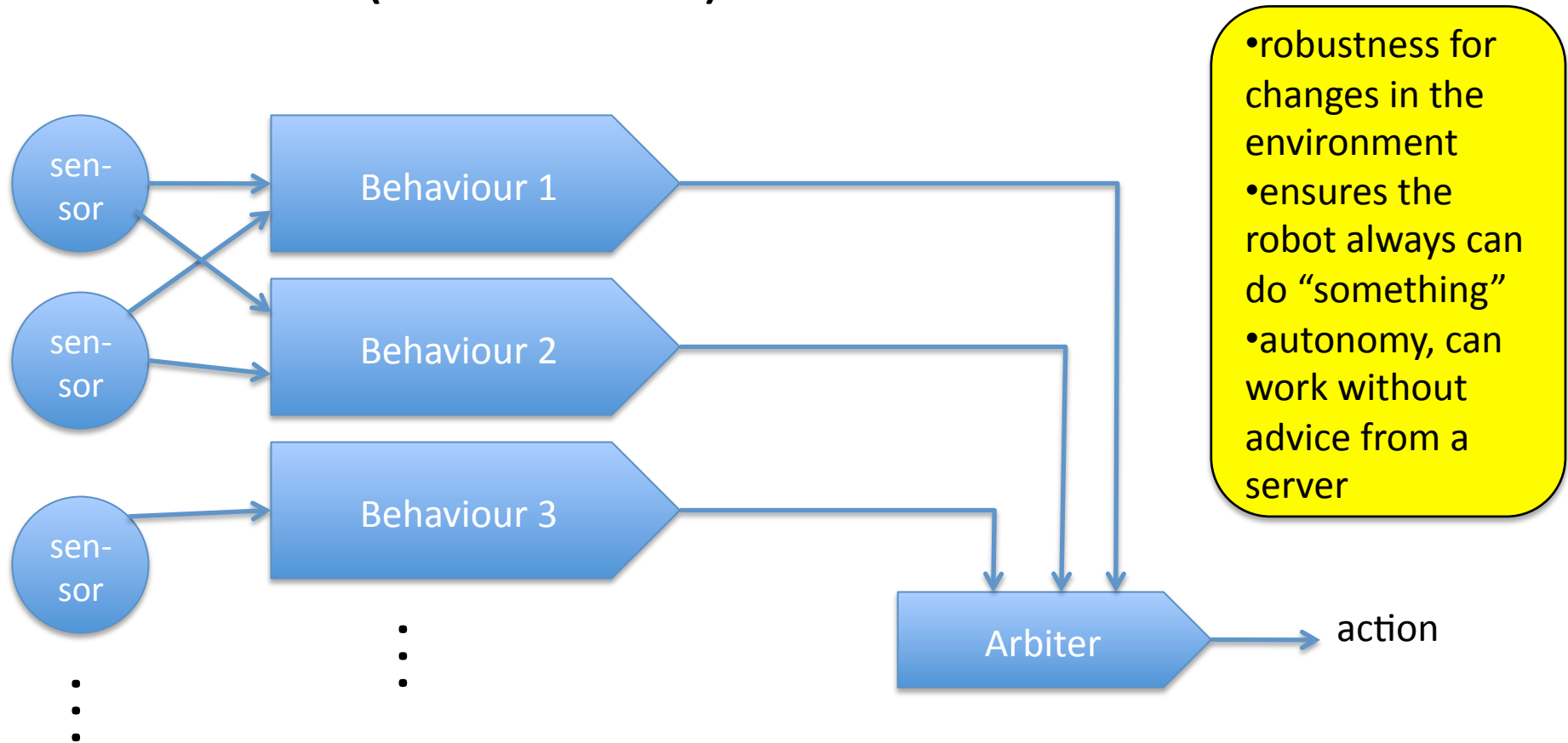
A course given by Henning Christiansen

Spring semester 2009

What is a robot?
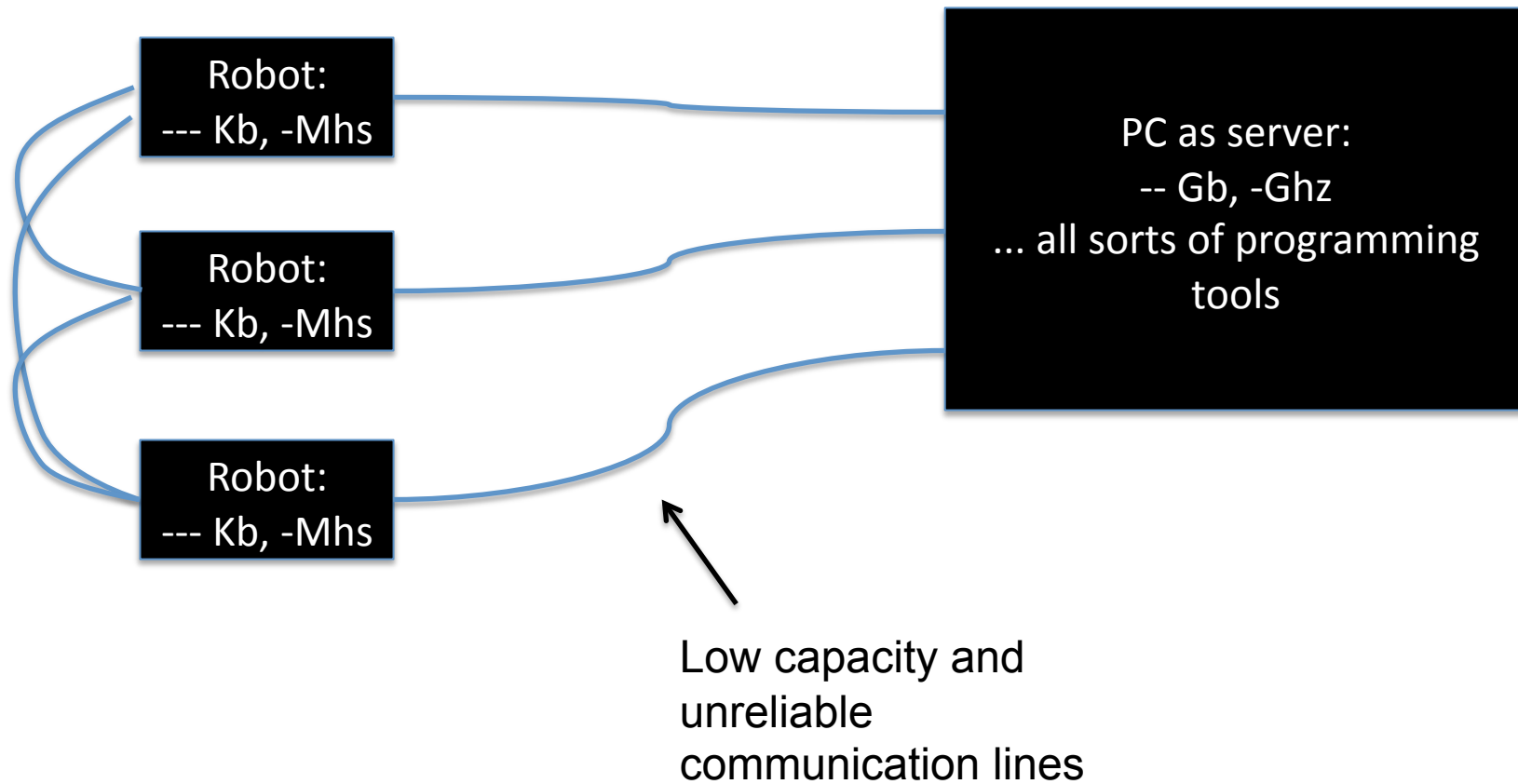
- Autonomous artifact
  - senses its environment
  - performs actions that affect the environment

- Application
  - Household, toys, …
  - Industry, replace manual work, work with very small or big things, repeated or boring tasks, can work in "inhuman" environments
  - Military ☹

- How to program a robot?
  - open the text editor and start programming
  - well, not really ….

"Behavioural robotics"

A software (+hardware) architecture for robots

Distributed programming

Robot:
--- Kb, -Mhs

Robot:
--- Kb, -Mhs

Robot:
--- Kb, -Mhs

PC as server:
-- Gb, -Ghz
... all sorts of programming tools

Low capacity and unreliable communication lines

This course is not about..

- competing in smart, fancy, useful, cute etc. robots

But:

- it is about software architecture

During the course we (=you) should document a software architecture, relevant tools etc, and illustrate by small, running application

You will learn about distributed, parallel, embedded, pervasive, etc. computing

Tools

Lego Mindstorms

- has solved hardware problems for us: sensors, motors, mechanics, communication, on-robot computer NXT

- firmware (a little op. sys. + language interp.)

- a simplistic programming language

leJos

- Java based environment for NXT

- JVM for NXT, class library for client + server, behavioural programming …
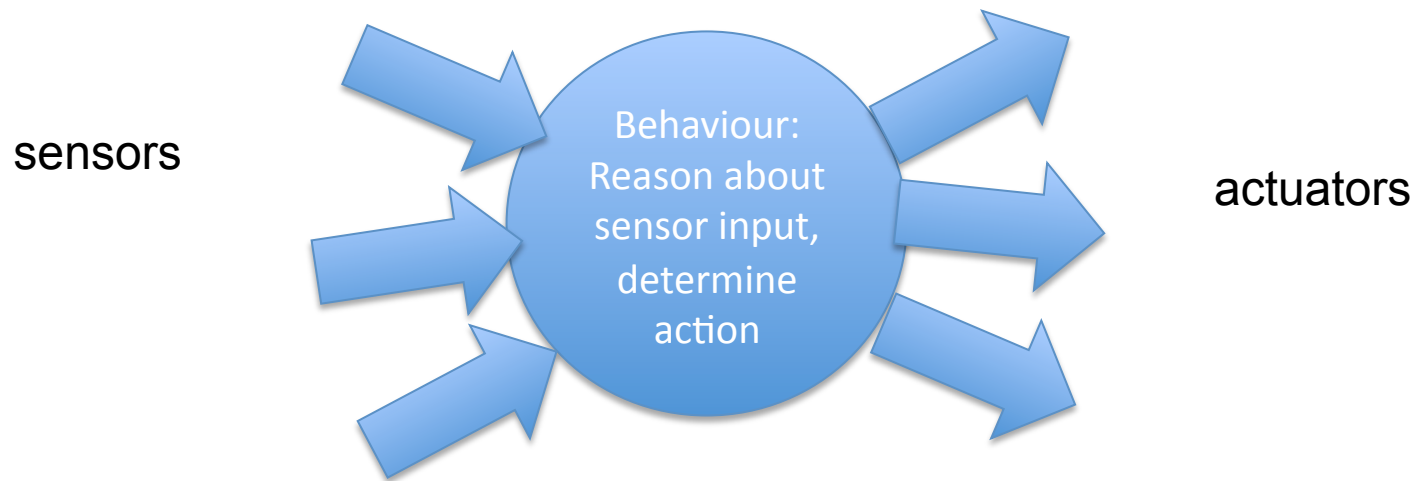
Practicals

- You must like to program and experiment!
- You can get inspiration for project + thesis work!
- You work in groups of 2–3 students with one Lego set; course dominated by practical work
- You should document your work in small "written assignments", that are given during the course and must be given in by fixed deadlines

Find all details here:

http://www.ruc.dk/~henning/ROBOT2009

A very brief introduction to (behavioural) robot programming

sensors

Behaviour: Reason about sensor input, determine action

actuators

Continue this process, measuring the actions' effect on reality
Perhaps several behaviours in parallel, or competing on which one takes precedence

A little advertisement movie

Is this a "behavioural robot"?

How much is fake and how much the programmed robot?

Today you will learn about

Basic robotics principles:

- sensors and actuators (e.g., motors), and how they appear from a robot program(mer)'s point of view

- programming to have the first determine actions of the second

How Lego's programming language and tools work

- a simplistic, graphical programming language

- how to put (simplistic) robot mechanics together

- how to feed a program from a server (= your computer) to the robot by USB and Bluetooth.

Today's program

- Divide around the too few Lego sets we have available today.

- Go through the "Getting started" and do the experiments and exercises that are mentioned

- make sure that everyone is engaged in every step that is made

- When this is finished, continue to extend you robot in the "Tribot" explained in the "User guide" and in the Robo Center part of Lego's development system

A few more practical remarks

We form the 2–3 student groups next week when we have more Lego sets

Lego sets stay at RUC, until we have agreed otherwise

Please

- Don't mix up the different sets (not allowed to borrow a brick from your neighbour!!

- Please place those parts that you don't use in plastic bags in an orderly way so that the box is useful for the next ones who open it