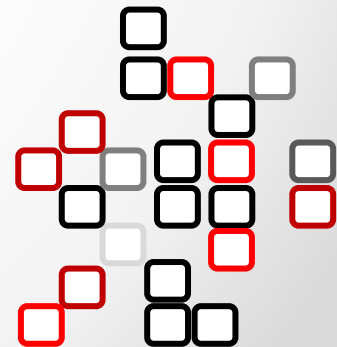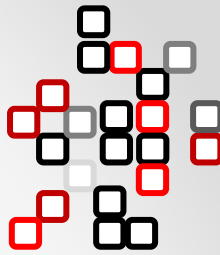# Autonomous Systems

Lecture 01
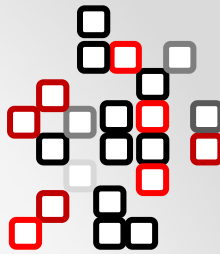## Introduction into the aAUTS

Martina Husáková

Contents

- **Content and objectives of the subject**
- **How to successfully pass the subject?**
- **Point system**
- **Exam**
- **Study materials**
- **Contact**

Content and objectives (1)

Autonomous systems ↔ **Complex systems**

Analysis and design of the MAS

MAS development in the NetLogo

Ontologies and semantic web

Game theory

Formal knowledge representation on the web

NetLogo programming - advanced concepts -
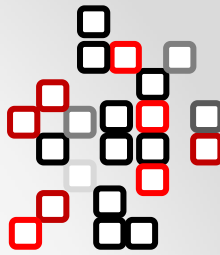
3rd year of study

4th year of study

Content and objectives (2)
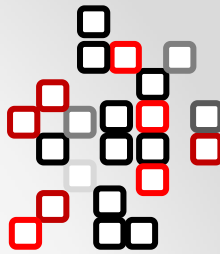
- **Analysis and design of the autonomous system called Multi-Agent System**
  - *Initial steps:*
    - Topic selection
    - State of the art preparation
      - Literature research
      - Mind mapping
      - Citations
  - *Analysis:*
    - PEAS
    - ODD plus D
  - *Analysis and design:*
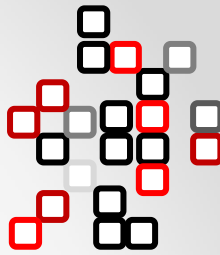   - Semi-formal modelling in AML

Content and objectives
Topic selection

1	Social insects as the multi-agent system
2	Rescue operations with autonomous robots
3	Bots as intelligent agents in computer games
4	Automated robot gardener
5	Intelligent e-learning system based on multi-agent paradigm
6	Intelligent home
7	Simulator of viral (bacterial) infection
8	Own topic for the project

See the list with topics in my Ukazky directory/Husakova
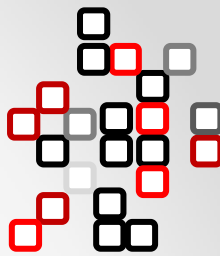
Content and objectives (4)
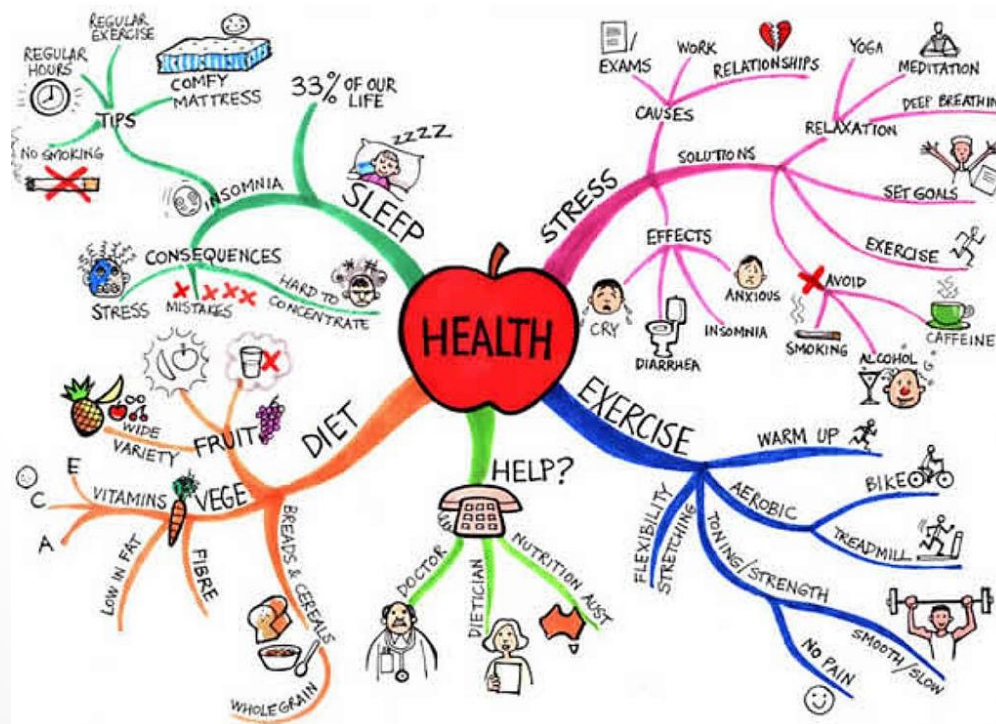## State of the art preparation

- **Analysis and design of the system about which we do not know „almost anything" ☹ => to study information sources about our application domain**

- **State of the art:**
  - **Description of the application domain**
    - **What is going to be about?**
    - **Searching similar research works from the past and actual works which are focused on the building of the similar system as our system … Reason? We can be inspired by works of others. We can extend already proposed/existed system.**
    - **Citations of literature sources and following particular citation style**
  - **Additional questions that should be answered by us?**
    - **Why is it necessary to build the model and program for this system?**
    - **What will be added value of our proposed system?**
    - **What will be the main aim of our system and its purpose?**
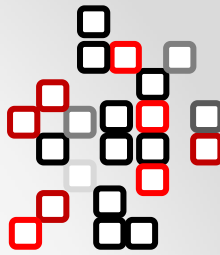
Content and objectives (5)
Mind mapping (cont.)

- **Mind map is the information structure providing <u>subjective</u> view on particular topic**

Source: http://www.tonybuzan.com/images/mm_health.jpg
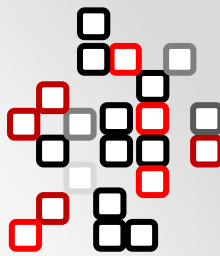
Content and objectives (5)
Mind mapping (cont.)

- **We are going to use this non-formal and creative approach for the state of the art preparation, i. e. the mind map will map literature sources and their content about our application area**

- **Example:**
  - **Goal: Development of the simulation model Predator-Prey**
  - **Mind map will cover <u>research works</u> about Predator-Prey modelling together with their brief content and main aim of these models**
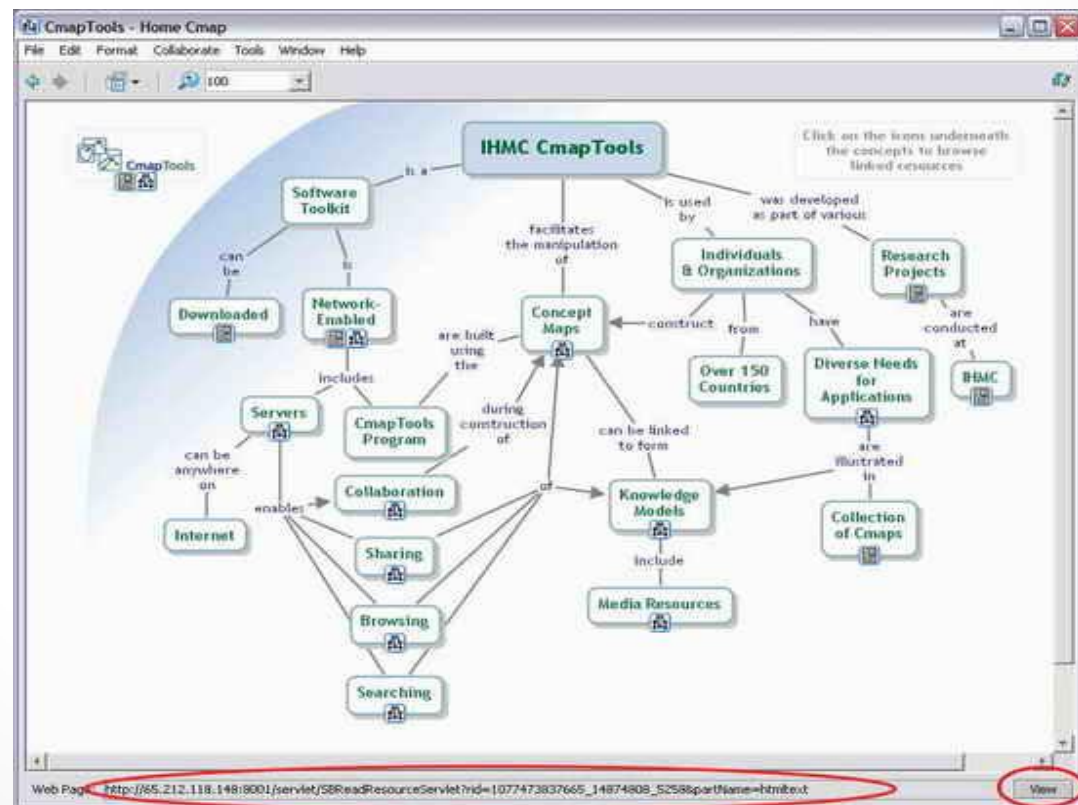
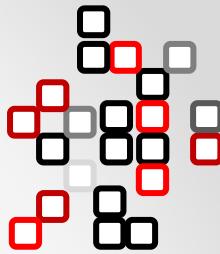# Content and objectives (5)
Mind mapping (cont.)

- **The CmapTools software (available for download at: http://cmap.ihmc.us/products/) developed at the Institute for Human and Machine Cognition**
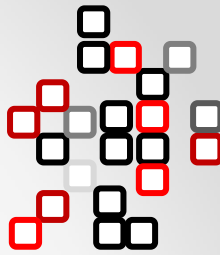
Content and objectives (6)
## Analysis

- **PEAS – brief look on the MAS structure**
  - **Performance measure**
  - **Environment**
  - **Actuators**
  - **Sensors**

- **ODD+D protocol – more detailed look on the MAS architecture, behaviour and performance**

Content and objectives (7)
Analysis and design

- **Analysis and design of multi-agent systems**
  - **We are not going to program the MAS (aCOS, aGT)**
  - **We are going to create conceptual models of the MAS**
  - **These models are the basis for programming the MAS**
  - **AML language is going to be used for analysis and design the MAS**
    - **AML = The Agent Modelling Language**
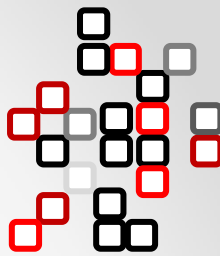 - **AML extends the UML – 11 new diagrams**
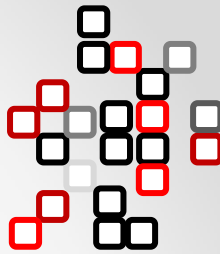
Recommendation!

- **The study of the aAUTS is based on the basic knowledge of the object-oriented principles because of the AML:**
  - o the principle of the inheritance, polymorphism, abstraction, encapsulation
  - o knowledge of a construction of the UML class diagram (attributes, methods, visibility of attributes and methods)
    - use case diagram
    - class diagram
- **If you are not familiar with the OO principles and UML, you will have to study very hard. We will not have a time to teach the OO principles and UML during the semester.**
- **Advice: to attend the UOMO subject that is taught by dr. Pavel Čech (pavel.cech@uhk.cz).**
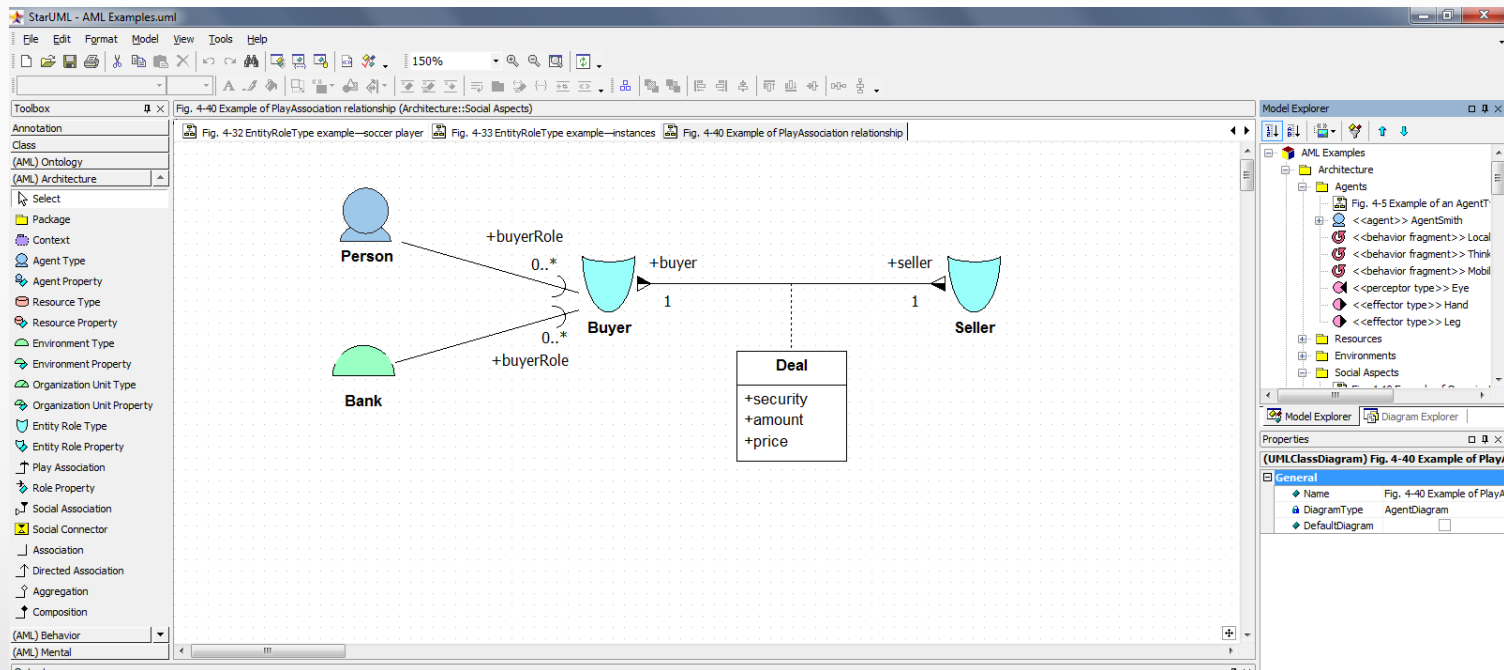
Content and objectives (8)
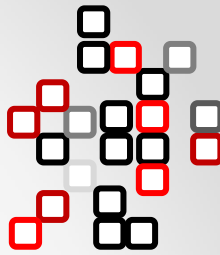## Analysis and design

- ## StarUML <u>5</u>

  - o **Freely available software**

  - o **Downloading:**
    http://sourceforge.net/projects/staruml/files/staruml/5.0/

Content and objectives (8)
Analysis and design

- **Plugin for AML in StarUML <u>5</u>**

    o **Freely available profile**

    o **Downloading:**

    http://staruml.sourceforge.net/v1/modules.php
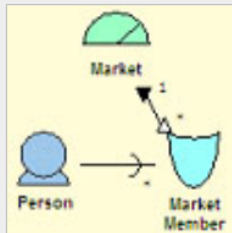
   **AML (Agent Modeling Language) Profile**
    This module is an implementation of the UML 2.0 Profile for the Agent
    Modeling Language (AML). The AML Profile supports the production of
    AML models for the analysis and design disciplines of software
    application development, especially where applications draw on multi-
    agent systems theory and engineering practice. The profile implements
    all features of the version 0.9 of AML, which offers support for: multi-
    agent system entities, ontologies, social aspects, behavior abstraction
    and decomposition, communicative interactions, services, observations
    and effecting interactions, mental aspects, deployment, and mobility.
    (License: Modified BSD)
    *Contributed by Radovan Cervenka(rce@whitestein.com), Whitestein
    Technologies*
    Link to Download (installer, examples, documents, ...)
    screenshot

Plugin is also available in my Ukazky directory/Husakova
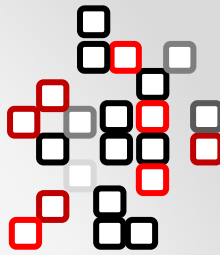
Content of lectures

| |
|---|
| **Lecture 1: Introductory lecture into the aAUTS** |
| **Lecture 2: Introduction to the agents and multi-agent systems** |
| **Lecture 3: Knowledge representation (concept maps, mind maps, ontologies)** |
| **Lecture 4: Intelligent agents: architectures and interactions** |
| **Lecture 5: Knowledge-based technologies and management** |
| **Lecture 6: Object-oriented modelling and UML** |
| **Lecture 7: AML – part 01** |
| **Lecture 8: AML – part 02** |
| **Lecture 9: Expert systems** |

Changes are possible …
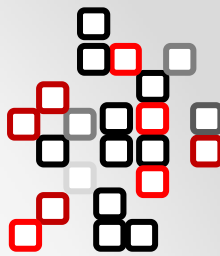
Content of seminars

Week 3	08.10.2018	Introduction to MAS, NetLogo models Homeworks: see seminar 1
Week 4	15.10.2018	State of the art (literature review) Selection of a topic of a project (obligatory!!!)
Week 5	22.10.2018	Mind mapping
Week 6	29.10.2018	Control day: presentation of the state of the art and the mind map (obligatory!!!)
Week 7	05.11.2018	PEAS, ODD+D
Week 8	12.11.2018	UML
Week 9	19.11.2018	StarUML and AML: architecture of the MAS Control day: presentation of the MAS architecture (obligatory!!!)
Week 10	26.11.2018	StarUML a AML: architecture of the agents, project deadline 2. 12. Control day (obligatory!!!)
Week 11	03.12.2018	Presentation of projects
Week 12	10.12.2018	Exams
Week 13	17.12.2018	Exams, credits week

System of points – credits
Project
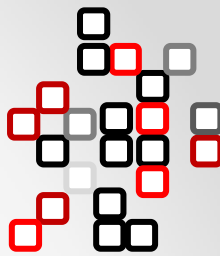
- **Analysis and design of the multi-agent system**
  - **State of the art preparation with mind mapping**
  - **Modelling in the AML with the StarUML**
  - **Presentation**
- **Follow the instructions that are mentioned in protocol for the project (Ukazky/Seminar01):**
  - **aAUTS-ProtocolForProject-2018.docx**
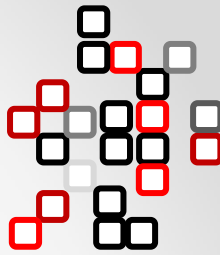 - **The protocol plays the role of the documentation of your project**
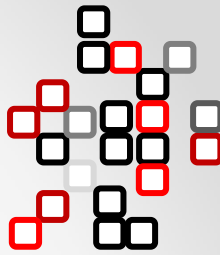
System of points – credits (3) Project

- **Project is not possible to revise!** Only one submission of the project is possible.

- **Submit the project on the email address: martina.husakova.2@uhk.cz:**
  - The protocol (*.docx or *.pdf)
  - The CmapTools project (source file)
  - The mind map in the jpeg, jpg file
  - AML source file with diagrams (*.uml)

- **Deadline: week 10 – 11. 12. 2018 23:59**

System of points – credits (2)
Presentation

- **Presentation of your project is necessary part of the complete evaluation of the aAUTS**

- **Credits cannot be taken into account without the presentation our your project**

- **Presentation should contain the most important information about the state of the art, mind mapping and created AML-based diagrams**

- **Time limit for presentation is max. 15 minutes**

- **Date for the presentation**
  - **11th week of the semester**
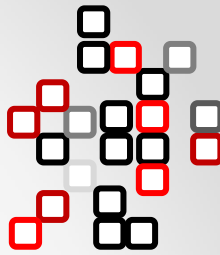
System of points - credits

- **Attendance on lectures is not compulsory, but it is recommended**

- **You can receive bonus points during the lectures/seminars which can be added into the total points for credits (not for the exam)**

- **Recap … for credits it is necessary:**
  - **Successful project: min. 70 points (max. 100 points)**
  - **Obligatory attendance during control days (… see table in the 16th slide)**
 - **Presentation of the project**
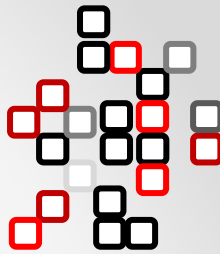
Exam

- **The subject is concluded by the exam**
- **Final evaluation of the subject:**
  - Credits are awarded on the basis of the fulfilment of conditions that are mentioned earlier. Student is evaluated according to the following scale in case of the exam:

    - 90 - 99+: A (1)
    - 80 - 89: B (1 - 2)
    - 70 - 79: C (2)
    - 60 - 69: D (2 - 3)
    - 50 - 59: E (3)
    - 0 - 49: F (4, 5)

- **In case of receiving lower points (< 50), the student is not successful**
- **Terms: in the 12th or 13th week of the semester and during the January (will be announced later!)**

Information in the IS STAG Syllabus

- **Syllabus of the aAUTS (2018/2019) is not completely actuall in the Stag!**

- **Please, see the actual syllabus that is saved in the Ukazky\Husakova.Martina**
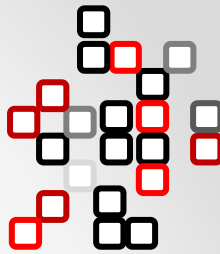
Study materials (1)

- **All important materials are available in the Ukazky\Husakova.Martina\...**
- **Recommended books**
  - Awad E. M. & Ghaziri: H. M: Knowledge Management, Prentice Hall - Pearson Education, 2004
  - Russell, S.; Norvig, P.: Artificial Intelligence: A Modern Approach (3rd Ed.). Prentice Hall, 2009
  - Horling, B.; Lesser, V.: A Survey of Multi-Agent Organizational Paradigms. The Knowledge Engineering Review, 19(04), 281 - 316
  - Cervenka, R.; Trencansky, I.: The Agent Modeling Language - AML: A Comprehensive Approach to Modeling Multi-Agent Systems,Springer, 2007
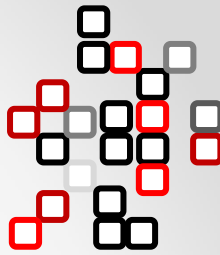
Study materials (2)

- **Brett D. McLaughlin, Gary Pollice, David West: Head first object-oriented analysis and design (2007)**

- **Mike O'Docherty: Object-oriented analysis and design : understanding system development with UML 2.0 (2005)**

- **Jim Arlow and Ila Neustadt: UML 2 and the unified process : practical object-oriented analysis and design (2005)**
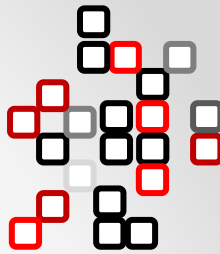
Contact

- **Martina Husáková**

- **Department of Information Technologies FIM (KIT)**

- **Office nr. 311 (Building J, 3rd floor, KIT)**

- **Email: martina.husakova.2@uhk.cz**