STUDENT ENGINEERING OFFICE AND VIRTUAL INSTRUMENTATION AS A LEARNING ENVIRONMENT

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Agenda

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INTRODUCTION

1. HIGHER EDUCATION IN FINLAND
   - OVERVIEW
   - STATISTICS
2. CHALLENGES OF ENGINEERING EDUCATION
   - NEW PROFILE OF STUDENTS
   - PROBLEMS OF SMALL CITIES
3. CHANGES OF LEARNING AND TEACHING
   - SOME SOLUTIONS AND METHODS
   - STUDENT ENGINEERING OFFICE

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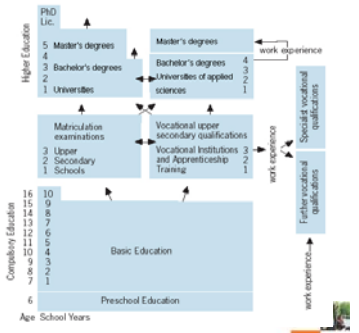
RESOURCES AND METHODS

4. MODELING AND SIMULATION
   - ENGINEERING WORK
   - VIRTUAL INSTRUMENTATION
   - MODELING
   - DOMAIN-SPECIFIC MODELING

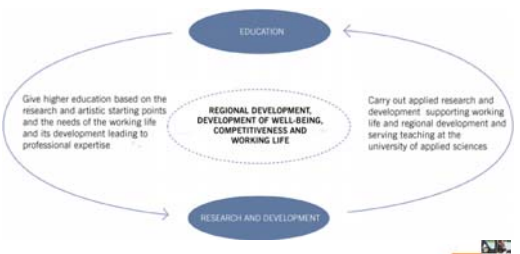
RESULTS

DISCUSSION

UNIVERSITIES OF APPLIED SCIENCES IN THE FINNISH EDUCATION SYSTEM



TASKS OF THE UNIVERSITIES OF APPLIED SCIENCES



STATISTICS

MINISTRY OF EDUCATION SECTOR:

- –20 UNIVERSITIES
- –28 UNIVERSITIES OF APPLIED SCIENCES

+ ÅLAND UNIVERSITY OF APPLIED SCIENCES
(THE SELF-GOVERNING PROVINCE OF ÅLAND)

+ POLICE COLLEGE (MINISTRY OF THE INTERIOR)

THE NUMBER OF THE AGE GROUP: 62 000 . . . 67 000

IN 2007 THE ENROLMENT (NEW STUDENTS):

–22 000 UNIVERSITIES

–36 000 UNIVERSITIES OF APPLIED SCIENCES

(NEW STUDENTS ARE TYPICALLY FROM 3...4 DIFFERENT AGE GROUPS.)

IN 2006 THE NUMBERS OF GRADUATES

–3800 BACHELOR'S DEGREES AND 13 128 MASTER'S DEGREES (UNIVERSITIES)

–20 767 BACHELOR'S DEGREES AND 239 MASTER'S DEGREES (UNIVERSITIES OF APPLIED SCIENCES)

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IN 2006 ENGINEERING STUDENTS:

–NEW STUDENTS

- 3770 (UNIVERSITIES)
- 10 589 (UNIVERSITIES OF APPLIED SCIENCES)

–GRADUATES

- 2962 (UNIVERSITIES)
- 5428 (UNIVERSITIES OF APPLIED SCIENCES)

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CHALLENGES OF ENGINEERING EDUCATION

NEW PROFILE OF STUDENTS:

–MORE STUDING POSSIBILITIES

–"SURFING GENERATION"

–NEW SKILLS

–LESS SCIENCE / MATHEMATICS STUDIES

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ENGINEERING EDUCATION IN CRISIS?

–IMAGE OF ENGINEERING

–NO MORE SO INTEREST CAREER

–NOT ENOUGH STUDENTS

–TOO EASY TO BEGIN STUDIES

–DIFFICULTIES WITH STUDIES

–POOR MOTIVATION

–MORE INTERRUPTIONS

–LOWER LEVEL

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PROBLEMS OF SMALL STUDY CITIES:

–STUDENT LIFE

–SOCIAL LIFE

–POSSIBILITIES TO DO PART-TIME WORK

–> "STRUCTURAL DEVELOPMENT"

–SIZE, HIGH QUALITY, EFFECTIVENESS, INTERNATIONALISM, ...

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CHANGES OF LEARNING AND TEACHING

–NO MORE T&W (TALK AND WRITE) -METHOD

–TEACHER IS A TRAINER

–SOME METHODS:

- COLLABORATION LEARNING
- TEAM WORK
- PBL
- LEARNING BY DOING
- LEARNING IN PRACTICE OR IN WORKING LIFE

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- ONLINE TEACHING
- E –LEARNING
- VLE
- LEARNING PLATFORMS (WebCT, Moodle, ...)
- LAPTOPS, MOBILE LEARNING DEVICE
- PROJECTS (e.g. ASL)

STUDENT ENGINEERING OFFICE in OUAS

–AFTER THREE YEARS' STUDIES

–STEP TO WORKING LIFE

–NORMAL WORKING TIME (PARTLY WITH TEACHERS, PARTLY TEAM WORK)

–DIFFERENT COURSES: PROJECT WORK, PRACTICAL TRAINING, FREE-CHOICE STUDIES, BACHELOR'S THESIS, ...

–VIRTUAL INSTRUMENTATION AND SIMULATIONS AS A LEARNING ENVIRONMENT

NEW EXPERIMENT OF STUDENT ENGINEERING OFFICE

–FIRST PERIOD AND FIRST STUDY COURSES

–OUR ADVICE TO NEW STUDENTS:

- LEARN TO STUDY
- LEARN TO COOPERATE
- FIND GOOD MOTIVATION
- BE COMMITTED TO OUR SCHOOL
- ...

RESOURCES AND METHODS

MODELING AND SIMULATION

- ENGINEERING WORK
- VIRTUAL INSTRUMENTATION
- MODELING
- DOMAIN-SPECIFIC MODELING

RESULTS / DISCUSSION

ENGINEERING WORK = Engineer's job

The engineer in an IT company is a software or hardware designer

1. Design

   evaluating the new research algorithms with models and simulations, exploring and developing algorithms

2. Prototyping

   implementing models to the prototypes and integrating them to the hardware

3. Deploying

   scaling prototypes to the field as customer devices

To practice these phases of the work of engineers the virtual instrumentation tool like LabVIEW gives a good possibility to go to the key issues in the problem solving.

VIRTUAL INSTRUMENTATION as learning and teaching "tool" in OUAS

LabVIEW tool of National Instrument has been used already over ten years also as the tool of learning programming.

Two courses concerning virtual instrumentation.

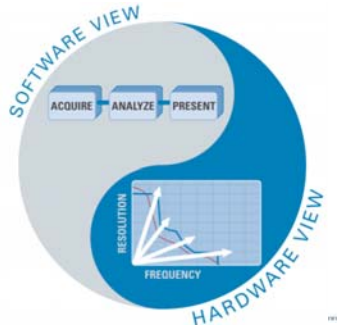
Bachelor's Thesis works in the field of virtual instrumentation, for example applications to the industry like Ruukki, Steel Factory and Elektrobit, IT company.

Bachelor's Thesis works "to our own use" for example simulations in the physics laboratory.

In our automation laboratory we have a laboratory work, application of real world I/O measurement.

LabVIEW is the common factor in the Student Engineering Office.

The Virtual Instrumentation Approach



Analyze with LabVIEW

Powerful measurement analysis is built in to the LabVIEW development environment.

LabVIEW includes the following tools to help you analyze your data:

- More than 400 measurement analysis functions for Differential Equations, Optimization, Curve Fitting, Calculus, Linear Algebra, Statistics, etc.
- 12 new Express VIs specifically designed for measurement analysis, including filtering and spectral analysis
- Signal Processing VIs for Filtering, Windowing, Transforms, Peak Detection, Harmonic Analysis, Spectrum Analysis, etc.

Educational Applications of Virtual Instrumentation

Simulations in Physics

Simulations in Mathematics

Simulations in Signal Processing

Design filters

Design embedded applications

Environment/tool for basic programming

Environment of advanced programming, design patterns and frameworks

Simulations in Measurements and control

System simulation and identification

Demonstrations of Industrial Applications

MODELING

Virtual instrumentation is a one way to build models.

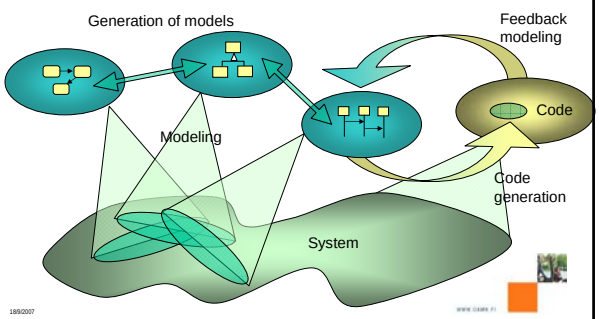
To be expert designer it requires understanding of the very basic ideas of modeling.

Modeling helps to visualize the system and it enables to specify the structure or behavior of a system. Every model may be expressed at different levels of precision. The best models are connected to reality. No single model is sufficient.

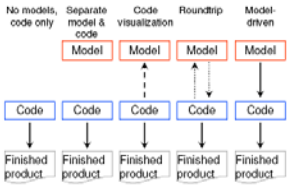
In the software engineering is used the de facto standard UML, Unified Modeling Language 2.0 means code visualization approach with 13 different diagrams.

The natural trend is to move to the model driven development in the embedded system engineering.

MODELING



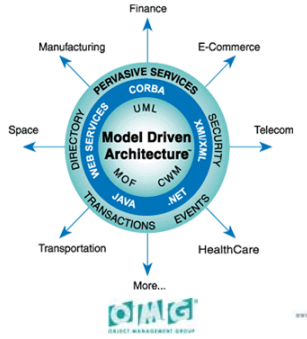
How to use models?



- Models should be complete from the modelers pespective
  - In the past only full transformation has worked!

What is a model? The code is the model. Manage code and model. The model is the code. Let's talk models.

MDA = Model Driven Architecture = MDD = Model Driven Development



An OMG initiative to support model-driven development through a series of open standards

(1) ABSTRACTION (2) AUTOMATION

MDA™

(3) OPEN STANDARDS

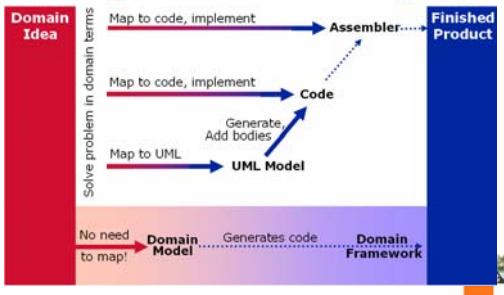
- Modeling languages
- Interchange standards
- Model transformations
- Software processes
- etc.

DOMAIN-SPECIFIC MODELING

Using LabVIEW tool is already filling the idea of the model driven development, specially building virtual instrumentation applications.

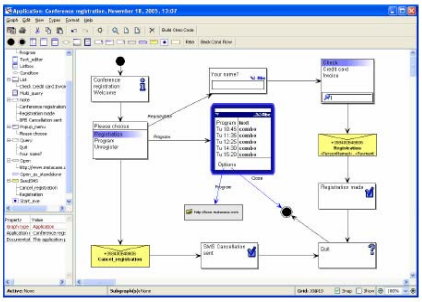
More generally Domain-Specific Modeling (DSM) is an approach for designing and developing solution directly using the domain concepts in the software engineering.

Modeling domain vs. modeling code



Smartphone application

Smartphone application



RESULTS and DISCUSSION

Challenges in studying to become an Engineer

The student engineering office = the place to learn the work of the software/hardware engineer/designer

- to understand the higher level of abstraction by using the models and prototypes
- to learn programming and basic professional courses by simulation and demonstration
- to carry out Bachelor's Thesis works to the industry
- to work, " the real working environment" with coffee breaks and time tables
- to understand the key skills in the work of an engineer as the expert designer and developer of the new applications

Challenges in teaching young future engineers

- motivation to study and work
- management of changes

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The future

Thank You!

Timo and Leo

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