Module Modeling and Analysis course info

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Abstract
This module provides the information about the “Modeling and Analysis” course.

The complete course MA 611™ is owned by TNO-ESI. To teach this course a license from Buskerud University College is required. This material is preliminary course material. The final material and course information can be found at: www.esi.nl/cursus.
## goal of this module

Provide overview and context for complete course.

Understand and experience the connection between problem and solution.

## content of this module

Positioning of Modeling and Analysis (M&A)

Why, what and how of M&A

Program of the complete course

Overview of M&A approach

## exercise

Quick scan of one case

Electronic Patient Record, Video on Demand, or Health Care Archive
Abstract
The course Modeling and Analysis is described. The program consists of 10 modules. The course format, iterating theory, illustration and interaction is explained. The course heavily emphasizes the practical application of the method. This presentation shows the overview of the modeling and analysis approach and the methods and techniques that will be elaborated in the rest of the course.
Positioning Modeling and Analysis in Architecting

vague notion of the problem

architecture description:
- articulated
- structured
problem and solution

vague notion of potential solutions

know-how

architecting

basic methods

modeling and analysis

architecting method:
- framework
- submethods
- integration methods

Report
Spec
Design

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Modeling and Analysis supports:

- understanding
- exploration
- optimization
- verification

Type of model depends on project phase
Models have a goal
Goals evolve and models evolve
Techniques are used to reach this goal
Purpose of Modeling

- facts from research
- measurements
- assumptions

modeling

- uncertainties
- unknowns
- errors

analysis

- accuracy
- working range
- credibility

results

project

- risk
- customer satisfaction
- time, cost, effort
- profit margin

specification
verification
decisions
What to Model?

business:
- profit, etc.
- operational costs
- stakeholder benefits
- workload
- risks

key performance:
- throughput, response
- reliability
- availability
- scalability
- ...

(emerging?) properties:
- resource utilization
- load
- latency, throughput
- quality, accuracy
- ...

and their mutual relations

usage context
- enterprise & users

system
- requirements
- black box view
- design
- realization
- technology

life cycle context
- creation
- life cycle business

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## Program of Modeling and Analysis Course

| Day 1 | 1. overall approach  
| intro, overall approach, exercise overall approach |
| Day 2 | 2. input facts, data, uncertainties  
| quantification, measurements, modeling, validation, technology  
background, lifecycle and business input sources |
| Day 2 | 3. system modeling  
| purpose, approaches, patterns, modularity, parametrization,  
means, exploration, visualization, micro-benchmarking,  
characterization, performance as example |
| Day 2 | 4. application, life-cycle modeling  
| reiteration of modeling approach (see module 3), applied on  
customer application and business, and life cycle |
| Day 3 | 5. integration and reasoning  
| relating key driver models to design models, model based threads  
of reasoning, FMEA-like approach, modeling in project life-cycle |
| Day 3 | 6. analysis, using models  
| sensitivity, robustness, worst case, working range, scalability,  
exceptions, changes |
Overview of Approach

- collect input data
- model and analyse relevant issues

integration and reasoning

- facts from research
- measurements
- assumptions

modeling
analysis
results
decision making

- usage context
  - enterprise & users
  - requirements black box view

- system
  - design realization technology

- life cycle context
  - creation
  - life cycle business
  - life cycle context

- diagnostic
- image
- IQ spec
- throughput
- purchase price
- BoM
- CPU
- memory budget
- Moore's law
- render engine
- nominal depth limit

- profit margin
- standard workstation
- CoO
- Moore's law
- purchase price
- BoM
- B
- U
- M
- P
- T

for different stakeholders & concerns

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MAOoverview
Abstract
The background ideas of the Modeling and Analysis course are collected in a number of diagrams. These diagrams are provided solely as background and probably should not be shown during the course itself.

Distribution
This article or presentation is written as part of the Gaudí project. The Gaudí project philosophy is to improve by obtaining frequent feedback. Frequent feedback is pursued by an open creation process. This document is published as intermediate or nearly mature version to get feedback. Further distribution is allowed as long as the document remains complete and unchanged.
How to Model?

small, simple, goal-driven models
What and Why to Model

- **How well is the customer served?**
- **How credible becomes the solution?**
- **How much are time and effort reduced?**
- **How much is the risk reduced?**
- **How much is the solution improved?**

Purpose and type of model depend on project life cycle:
- Type of model and views depend on purpose.

**Customer**
- Key driver: e.g. productivity
- Risk

**Business**
- Key driver: e.g. SLA cost/price
- Risk

**Business as usual**
- Obvious
- Historic data
- Competitive data

**Modeling**
- Feasibility
- Communication
- Risk mitigation
- Exploration
- Validation

Decision factors:
- Accuracy of model
- Credibility of results
- Level of abstraction
- Working range
- Calibration of model
- Robustness of model
- Time to first results and feedback
- Effort
- Evolvability
  (adaptation to new questions)

- How much effort is needed to create model(s)?
- How much effort is needed to use and maintain model(s)?
- How much time is needed to obtain useful result?
Models, Measurements, Expectations and Assumptions

- Working range
- Accuracy
- Reliability
- Credibility

Purpose

Measurements
- Have

Models
- Calibrate
- Have

Expectations
- Basis for

Assumptions
- Sanity check

Analysis
- Exploration
- Optimization
- Verification

Understanding
Unkownns, Uncertainties, ...

usage context

enterprise & users
requirements
black box view

system

design
realization
technology

unexpected use
assumptions
uncertainties
unknowns
dynamics
interference

hidden properties
assumptions
unknowns
uncertainties
dynamics
interference
Model versus Reality

- Reality:
  - Complex
  - Full of surprises

- Model:
  - Simplifications
  - Assumptions
  - Implementation

\[ \text{Reality} \neq \text{Model} \]
Starting Points of the Course

practical, immediately applicable in day-to-day work

(inter)active: daily hands-on exercises on case(s)

target: understanding, insight; way-of-working

method, tool, language and domain agnostic
Modeling and Analysis Questions

1. Why do we model? - what are indicators that modeling and analysis beyond "business as usual" architecture is needed. What questions trigger M & A.

2. What do we model? - what kinds of views do we need to consider (4+1, IBM GS Method, Zachman, CAFCR)

3. When do we model? - what models are needed at various points in the project lifecycle.

4. What is the appropriate type of model? - formula, visualization, executable, simulation

5. What is the required accuracy of the model? - when do we achieve the desired risk mitigation

6. What is the appropriate level of abstraction? - how much details have to be taken into account, versus how much effort can we afford

7. How to calibrate models? - models are based on facts and assumptions. The model outcome depends strongly on these input data. Note again the tension between effort to make and calibrate versus the value in terms of risk mitigation.

8. How to use models?
Recommendations as Red Thread

**principles**
- use feedback
- work incremental
- work evolutionary
- be explicit
- make issues tangible

**objectives**
- support communication
- facilitate reasoning
- support decision making
- create understanding
- maintain insight
- overview

**recommendations**
- Time-box
- Iterate
- Quantify early
- Measure and validate
- Multiple levels of abstraction
- (Simple) mathematical models
- Analysis of accuracy and credibility
- Multi-view
- System and its context
- Visualize

translate into
help to achieve
translate into
Cases for exercise

Electronic Patient Record:
+ relevant health care related information available at the right place for the right person

Long Term Health Care Archive:
+ extreme robust, persistent, high availability archive for large chain of hospitals

Video on Demand Backoffice:
+ large scale content database with fast response download capability including billing, DRM et cetera
Modeling and Analysis Exercise

- make a quick scan over the following views:
  0. what is this exercise about?
  1. context: stakeholders, concerns, application
  2. system design and realization
  3. requirements
  4. operational context
  5. qualities
- use time boxes of 15 minutes per view
- show the most dominant decomposition(s) of that view, as diagram or as a list; quantify whenever possible
Reflection on Exercise

+ collectively we know quite a lot
+ broad overview in short amount of time
~ some "hot" issues appear to be less relevant
- #questions >> #answers

baseline for next refining steps
Conclusions

Modeling and Analysis must provide more *in-depth* answers for questions that are *breadth* relevant.

Modeling and Analysis is a means that supports *requirements* management, *architecting* and *project* management.

Modeling and Analysis ranges from *business* aspects to *technical* decisions.

Good models are *small*, *simple* and *goal-driven*.

Techniques, Models, Heuristics of this module

Context viewpoints

Fast iteration based on time-boxing