



# Course Syllabus

*EH2780*

*IT Management with Enterprise Architecture II, Case Studies*

*12.0 credits*

*Fall 2012*

## Background

Today there are information systems for most of the tasks performed in an enterprise. There are customer management systems, contract management systems, product design systems, production systems, financial systems, human resource systems, business intelligence systems, asset management systems, waste management systems, document management systems, workflow management systems, and hundreds of other systems. In recent years, these systems have been integrated with each other to such an extent that it is oftentimes necessary to view them, not as hundreds of different systems, but as one single system of systems.

The resulting enterprise-wide information system is under constant change. Every year, new systems are developed and introduced, old systems are extended, modified, integrated with each other, and retired. In large enterprises, these changes are the result of many different stakeholders' requirements and many developers' actions. It has become increasingly evident that there is a need to plan and manage the evolution of this system in order to keep chaos at bay.

In this course, an approach to enterprise information systems management that relies on models of the information systems and their environment called Enterprise Architecture (EA) is presented. The main idea is very old. Instead of building the enterprise information system using trial and error, we propose an approach using models to predict the behavior and effects of changes to the system. The enterprise architecture models allow reasoning about the consequences of various scenarios and thereby support decision making. In order to predict whether scenario A or B is preferable, three things are needed. Firstly, models over the two scenarios must be created. Secondly, it is necessary to define what is desirable; the goals. Do we want the systems to support business processes efficiently or is organizational flexibility more important? Is it more important with high system availability than high information security or maintainability? Thirdly, we need to understand the causal chains from scenario choice to goals. Scenario A features hardware redundancy that positively affects the system reliability which in turn improves the service availability, leading to more efficient business processes. However, scenario B is built on a loosely coupled technology, which promotes the modifiability of the system. This, in turn, may be expected to have positive effects on the organizational flexibility.

In this course, the students will learn what we believe is the most central part of information systems management, namely how to rationally determine what actions to take with respect to information systems in order to support the goals of the user organization. Examples of goals that often are important to user organizations are system qualities such as the availability of the system (e.g. measured in uptime), the cost of the system (e.g. measured in €), the fit between functions and functional requirements, the quality of the processed data, the modifiability of the system, etc.

## Course goals

At the start of the course, you will form small groups of two to four persons. Each group will be assigned one or several information systems in operational use at some organization. The main concrete result expected of you is a set of recommendations regarding the future evolution of the system and its enterprise environment. The recommendations will be

presented to the owner organization, which might choose to implement the recommendations.

In order to generate the system development recommendations, you are expected to employ the enterprise architecture methods and tools provided in the course. The goal of the course can be summarized in the following two learning objectives:

- What are the factors that affect various quality properties of information systems, and through what mechanisms do they act?
- How can enterprise architecture modeling and analysis be employed to predict the effects of changes to the factors on the qualities?

## Pedagogical Stance

In this course, we want you to take control of your learning. You should be free to learn in any way you like. Of course, as teachers and examiners, it is our responsibility to provide the content of the course and to assess that you indeed have learnt that content at the end of the course, but we believe that you are the better judge of *how* you best acquire that content. Our role is therefore two-fold: i) at a few very specific occasions, we will assess your mastery of the course contents, ii) during the rest of the course, we attempt to provide you with an environment in which you can learn freely and efficiently (and without being evaluated). To give you control, there are very few compulsory elements in the course. If you do not believe that a certain lecture, seminar or exercise will help you learn, you need not participate in it. But as you take control over the learning process, you also mantle the responsibility of it. You plan your project. You search for and find the information you need.

As mentioned, it is our responsibility to provide a fertile learning environment. For that, we have a plethora of learning tools. These include a book and other reading materials, a software tool, films, tutorials, examples, exercises, guest lectures, seminars, designated tutors and teachers prepared to assist you according to your needs (and their capabilities). This material is available, most of it is strongly recommended, but its consumption is not mandatory. There will be very few planned lectures on planned topics. Instead, you can request the lectures you feel that you need.

## Examination

In order for the course's pedagogical stance to work, the examination must be well aligned with the learning goals. The grade will be based on two reports written by you in order to convince the case study organization of your study's results. The first report is written early and aims to convince the case study organization of the benefits of the study to be conducted. What's in it for them? The second report presents your recommendations and aims to convince the case study organization of the credibility of those results. Why should they follow your proposals?

**1. Case study motivation report.** Write a report to the case study organization motivating your study. Why should the organization spend their valuable time providing you with information? What will the benefit be for them? You should write the report to convince someone with about the same background knowledge that your co-students had before starting this course. The report should be no more than 3 000 words. It will be evaluated on

how strong an argument it makes to the case study organization for performing the study, i.e. how convincing it is. The strength of your argument will be assessed using the Toulmin method. Cf. <http://writing.colostate.edu/guides/reading/toulmin/index.cfm> or <http://www2.leon.leon.k12.fl.us/dewinterg/AP%20Lang%20Policies%20and%20Syllabi/Toulmin.pdf> for more information on this approach; the important message of the Toulmin method is that it is the content of your argument that is central: how convincing is it? Your case study motivation report should be in pdf format and submitted to your teachers, tutors and opponents at the date and time presented in the course schedule.

**2. Case study results report.** A report describing the results of the study constitutes the examination task of the basic assignment. The report should be no more than 15 000 words. The purpose of the report is to present your recommended changes to the user organization's enterprise architecture and to convince them to follow those recommendations. As in the previous report, you should assume that the reader has background knowledge corresponding to that of your co-students before starting this course. Also as for the previous report, the grade will depend on the strength of the presented argument. Examples of important questions to answer include "why is the recommended scenario better than the others?", "how can we trust the calculations that lead to these results?", "how do we know that the evaluated scenarios are the most relevant?", "how do we know that the current system is correctly modeled?", etc. It may be that your study cannot unequivocally propose a single recommendation. In that case, it is quite acceptable that your conclusion is "we cannot recommend anything", as long as your argumentation is solid. Your case study results report should be in pdf format and submitted to your teachers, tutors and opponents at the date and time presented in the course schedule.

**3. Extended case study results.** For the ambitious student, there is a bonus assignment (detailed below). The results of the bonus assignment should be reported in the same document, at the same presentation and in the same format as the basic assignment. The two assignments will be evaluated in the same manner. The report may be extended with 5 000 words if the bonus assignment is included.

**4. Presentation and opposition.** As a part of the examination, both of the aforementioned reports are presented before the class. These presentations are compulsory and may influence your grade. For each of the two reports, you are also obliged to read the report of one of the other groups in the class. During their presentation, you are expected to act as the opponent, discussing the strengths and weaknesses of their arguments. Prepare to present and make your opposition according to the following durations.

	Presentation	Opposition
Motivation report	20 min	10 min
Results report	40 min	20 min

For the case study motivation report, the group tutored by Johan Ullberg will be opponents to the group tutored by Markus Buschle. The group tutored by Markus Buschle will be opponents to the group tutored by Magnus Österlind. Finally, Magnus's group will be opponents to Johan's group. For the case study results reports, the above scheme is inverted, so Markus's group will be opponents to Johan's group, etc.

If the case study organization can allocate the time, you will also have the opportunity to make oral presentations of the contents of your reports to them. Those presentations will not influence your grade but may very well affect their decisions about the studied system.

In general, **grading** is only based on the quality of your reports and on your presentations (if the workload within the group is unfairly distributed or there are other special circumstances, we may deviate from this norm). 80% of the grade is based on the (extended) case study results report while 20% is placed on the case study motivation report. Although it is possible to obtain the highest grade through a well executed basic assignment, it will be much easier if you have also completed the bonus assignment.

## Course Description

The course consists of a set of activities for you to engage in. They are divided into an introductory assignment, a basic assignment and a bonus assignment of the course.

### Motivation

This part will support you in producing the Case study motivation report. Three topics will be discussed.

#### *Enterprise Information Systems*

**Objectives.** To convince your case study contacts of the benefits of your study, it is important to first understand the basic structure and management of their enterprise information systems. In this topic we attempt to support your learning of this subject.

**Support.** A newly-produced film is available in the electronic version of the course book to give you a first introduction to the problems of enterprise information systems. Furthermore, the course book contains two subchapters, *1.1 A brief history of enterprise information systems* and *1.2 The information systems of today*, relevant to this topic. A guest lecture featuring a practitioner aims to provide more concrete examples of the problems faced.

#### *Enterprise Architecture*

**Objectives.** Since your recommendations to the company will be based on an enterprise architecture approach, you will need to have some background on this discipline.

**Support.** Subchapter 1.3 of the course book, *A brief history of enterprise architecture*, provides some background. An article with the title "A Framework for Information Systems Architecture" that appeared in the IBM Systems Journal in 1987, authored by John Zachman is generally considered the starting point of enterprise architecture. This article is available for your perusal. A guest lecture by a practicing enterprise architect aims to deepen your understanding of the work in real organizations.

#### *Background to EA for Decision-Making*

**Objectives.** You will provide a recommendation for a decision that the case study organization can choose to make. To convince the organization that your approach is suitable as decision making support, you must be able to explain plainly how your use of enterprise architecture will lead to good recommendations.

**Support.** Subchapter 1.4 of the course book, *Enterprise architecture as decision making support*, explains how the two concepts can fit together. The introductory film in the course book makes the same case by an analogy to traditional architecture used in the construction of buildings. The Multi-Attribute Prediction (MAP) model is designed to return a utility score for each modelled scenario.



## Basic assignment

The basic assignment takes the Multi-Attribute Prediction (MAP) model for granted. The goal is to provide recommendations to the case study organization on future enterprise system evolution based on MAP.

*Model the system with the provided modeling language*

**Objectives.** In order to predict system qualities, the proper information needs to be collected. Modeling languages are well suited to codify the required data. The goal of this step is to model the case study system. In order to accomplish the task, you need to understand the modeling language, establish contact with your designated case study organization, conduct interviews, collect and study system and business documents, and finally actually do the modeling. Note that the contact people at the organization may have much on their plate. Early and active contact and meeting bookings are therefore key to the success of this activity.

Each student group is assigned a case study at the start of the course. Each group is also assigned an academic case study supervisor.

**Support.** In this task as well as all others associated with your case study, you will have available a dedicated case study tutor (typically a PhD student) to support your work. Your very first meeting should be with your tutor.

In order to gain access to the case study, it is also imperative that you establish contact with your case study contact person as soon as possible in order to book meetings and request documentation.

You are expected to use the EA<sup>2</sup>T software tool (the Enterprise Architecture Analysis Tool) loaded with the MAP model, for both modeling and prediction. Both the EA<sup>2</sup>T and the MAP are available for PC and Mac at <http://www.ics.kth.se/eaat>.

Course book Chapter 2 *Basic enterprise architecture modeling* provides introductory information on enterprise architecture modeling with EA<sup>2</sup>T. Course book chapter 3 *The multi-attribute prediction (MAP) model* details the MAP modeling language. The book also features an introductory tutorial. The MAP model is based on an established enterprise architecture metamodel called ArchiMate. More information about that language is available in the ArchiMate<sup>®</sup> 2.0 Specification.

A modeling exercise has been prepared for you. You are presented with a substantial batch of poorly structured information, just as you will be in your case study. The goal of the exercise is to transform the available information into a MAP model. A seminar is offered where your results of the modeling exercise are discussed. Submit your model before the submission date to participate and receive feedback on your modeling choices.

In a second seminar, your as-is model is reviewed by a peer group and discussed. This provides you with feedback on your own work as well as with the opportunity to see and learn from your course colleagues' work, which in many respects is similar to yours. Submit your model before submission date to participate.

*Model future candidate enterprise system scenarios with the MAP model*

**Objectives.** In order to recommend future developments of the system to the user organization, a set of future candidate enterprise systems scenarios need to be proposed. These scenarios can either be proposed by people from the user organization, or can be created by the student group.

**Support.** The same as for the previous task except for another seminar, a case study candidate model seminar. In this seminar, your candidate models are reviewed by a peer group and discussed.

*Model the user organization's requirements*

**Objectives.** To determine which scenario is the better, the user organization's requirements need to be taken into account. Is Service A more important than Service B? Is modifiability more important than Availability for Service A? What availability is minimally acceptable for Business process C? These and similar requirements can be captured using the MAP model.

**Support.** The same as for the previous task but no seminar.

*For all scenarios, predict the qualities supported by the MAP model*

**Objectives.** Prediction with EA<sup>2</sup>T and MAP is really quite easy. Just press the "Calculate" button, wait, and see the results. A likely outcome is that the attempt to calculate reveals problems in the model. These must then be remedied. Perhaps it is possible for you, after the analysis, to modify one of the scenarios in a realistic way to increase its utility to the user organization. If you can, make sure to improve the scenarios in this manner.

**Support.** The EA<sup>2</sup>T software tool. The MAP model. Your tutor.

*Justify your recommendations*

**Objectives.** Your recommendation ought to be the candidate scenario that results in the highest utility score for the user organization. The user organization will, however, need to understand how you came to that conclusion. Therefore, you will need to motivate your recommendations in plain language. Why is Scenario A better than B? Why did Scenario C have a lower modifiability than Scenario B? Why should we trust your estimation of the investment cost of Node X? Why is Y modeled as a service and not a function and how does that affect your prediction?

**Support.** Course book chapter 3 explains in detail the workings of the MAP predictions. It is also advisable to use the EA<sup>2</sup>T software tool (the Enterprise Architecture Analysis Tool) together with the MAP model to perform what-if analyses, considering the effects of various changes. In a seminar, your motivations for your recommendations are reviewed by a peer group and discussed in group. Your tutor is as always available for guidance.



## Bonus Assignment

In the bonus assignment, the MAP model is no longer taken for granted. Instead, the main task is to improve on it in order to make recommendations more tailored to the case study company.

*Augment MAP with a system quality of importance for the owner organization*

**Objectives.** MAP only contains analyses of a certain number of quality attributes, including modifiability, availability, interoperability, cost, etc. However, the case study organization may also be interested in other quality attributes, such as security, performance, organizational efficiency, or perhaps employee satisfaction, business profitability, etc. To ensure that your recommendations are not limited by the scope of the MAP model, this task aims to extend MAP to include one other attribute.

**Support.** Course book Chapter 3 details the MAP, and thus serves as the baseline for your augmentation. The EA<sup>2</sup>T software tool features not only the instance modeler application that you have employed so far, but also a second application to support model development. The casual relations in MAP are written in a language called the Object Constraint Language (OCL), which is a declarative language featuring set theory, arithmetics and predicate logic. The formal OCL specification is a good source to learn about OCL. Don't forget to make use of your tutor.

In a seminar, your additions to the MAP model are reviewed by a peer group and discussed.

*Re-analyze, re-recommend and re-justify.*

**Objectives.** After updating the MAP with your own quality attribute prediction mechanism, the enterprise architecture scenarios at the case study organization need to be re-evaluated and your recommendations updated. This task is similar to the final three tasks of the basic assignment.

**Support.** Most of the support provided in the previous tasks will be of use to you in this final step.



## Support

Offered as support in completing your work are a number of people, tools and documents. Please make use of them according to your own judgement.

### *Teacher*

The course responsible is your main contact regarding all issues of the course, unless otherwise stated.

### *Tutor*

Your dedicated case study tutor is available to support your work. You can expect the tutor to allocate in total eight hours of meetings to your project during the duration of the course. It is your task to manage the tutor's allocated time to best support your project. The tutor will also provide feedback on your models and reports.

### *Guest lectures*

To provide motivation to the course, two guest lecturers have been invited to explain to you, from the perspective of practitioners, the hopes and perils of enterprise information system management and enterprise architecture.

### *Case study contact person*

A contact person from the case study organization has been assigned to your group. Turn to this person for all matters related to the case study, including bookings of meetings, visits, and access to documentation.

### *Seminars*

A number of non-compulsory seminars are offered to support your project. Each seminar focuses on one essential ingredient in your report, such as the case study as-is models or the case study recommendations. To participate in the seminar, you are expected to turn in a deliverable (for instance, your case study as-is model) at a deadline a few days in advance. Before the seminar, your model will be reviewed by another group as well as by a teacher. You will also receive a deliverable to review. During the seminar, participants discuss strengths and weaknesses of their own and their course colleagues work. The seminars do not influence the grade but are solely offered as a means for you to improve the quality of your work.

### *Q&A Sessions*

A number of open question and answer sessions are available for your use. You may use these in two ways. The first option is the spontaneous Q&A session, where you participate to pose your own questions, hear your course colleagues' questions, and the teacher's answers. The second option is a pre-planned session where you in advance propose a certain topic for a lecture or seminar that you feel the need for. This allows the teacher (and possibly your colleagues) to prepare the material for the session.

### *Course book*

For the course, we have authored the book *IT Management with Enterprise Architecture*. Currently, it is available electronically both as an ePub and as an HTML book to read on your tablet device or computer. You can read or download the book on the course homepage on KTH Social.

### *The Zachman article*

In 1987, John Zachman wrote the article "A framework for information systems architecture" in the *IBM Systems Journal*, thereby setting the enterprise architecture discipline on its course. The article is well written and surprisingly relevant today, a quarter of a decade later. It is available on the course page at KTH Social.

### *The EA<sup>2</sup>T software tool (the Enterprise Architecture Analysis Tool)*

We hope you will employ the EA<sup>2</sup>T software tool extensively during the course. Developed at the department, it is capable of supporting enterprise architecture instance modeling, automatic prediction, and enterprise architecture class modeling. The EA<sup>2</sup>T is available for PC and Mac at <http://www.ics.kth.se/eaat>.

### *The Multi-Attribute Prediction (MAP) model*

Based on the ArchiMate metamodel, the Multi-Attribute Prediction (MAP) model is a UML class diagram to be used as a base for your modeling and prediction. It features capabilities to make predictions on the modifiability, availability, cost, interoperability, data accuracy, application usage and then to aggregate those quality attributes into a single utility score for a given scenario. The MAP is available at <http://www.ics.kth.se/eaat>.

### *The ArchiMate<sup>®</sup> 2.0 Specification*

The ArchiMate metamodel is a well-established language for enterprise architecture, currently developed by The Open Group (<http://www.opengroup.org>). It constitutes the base for the MAP model. The latest specification is available for you on the course homepage in KTH Social.

### *The OMG Object Constraint Language (OCL) Specification, version 2.3.1*

The causal relations in the MAP are specified in OCL. If you aim for the bonus assignment, this specification will be a good reference for you. It (in particular Section 7) is quite pedagogical about the OCL. The OCL specification is available for you at <http://www.omg.org/spec/OCL/>.

### *SCADA modeling exercise*

To assist your learning of the MAP model, a modeling exercise has been developed. A batch of semi-structured information regarding an enterprise system is available. The ambition has been to provide you with information not unlike what you might encounter in a real organization, such as your case study organization. The exercise consists of the transformation of the provided information into a MAP model. A seminar is available where you can receive feedback on your results.



## Teachers

The examiner and responsible for the course is Professor Pontus Johnson. Course secretary is Annica Johannesson. For all administrative business, such as travel expenses etc., please talk to the course secretary.

Name	Role	E-mail	Telephone
Pontus Johnson	Course ex.	<a href="mailto:pj101@ics.kth.se">pj101@ics.kth.se</a>	08-790 68 25
Annica Johannesson	Course secr.	<a href="mailto:annica.johannesson@ics.kth.se">annica.johannesson@ics.kth.se</a>	08-790 69 30
Markus Buschle	Tutor	<a href="mailto:markusb@ics.kth.se">markusb@ics.kth.se</a>	08-790 68 27
Johan Ullberg	Tutor	<a href="mailto:johanu@ics.kth.se">johanu@ics.kth.se</a>	08-790 68 23
Magnus Österlind	Tutor	<a href="mailto:magnuso@ics.kth.se">magnuso@ics.kth.se</a>	

## Administration and practicalities

All students in the course will have 24 hour access to the lecture room and the laboratory on the 7<sup>th</sup> floor (if these are not being used for other purposes, such as other courses).

**If the doors are kept opened too long the alarm will go off. If the alarm goes off when no one at the department is present, stay put, wait for the security personnel and explain your situation. Notify the course administration as soon as possible.**

Students will also have access to the coffee machine. Since we are many people sharing the same premises, it is necessary that good order be maintained, for instance by picking up trash and doing the dishes. Our cleaning staff is not responsible for dishes and the up-keep of the kitchen areas.

## Quotes vs. plagiarism

Please note that when solving the project assignments co-operation between students is encouraged. However, the project groups are responsible for the content of their own reports and plagiarism will result in a failing of the assignment in addition to a written report to KTH's central disciplinary committee. This means that all groups should write their own reports. If you want to use a quote from a source, "it must be clearly indicated that it is a quote [X]".

## Appendix 1, Schedule

27/8 13-15	Course introduction
29/8 15-17	Introduction to EA <sup>2</sup> T and MAP
3/9 13-15	Q&A session (Markus on EAAT)
7/9 8-10	Guest lecture (Johan Schubert, Capgemini)
10/9 10-12	Guest lecture (Margus Välja, Nordea)
10/9 13-15	Q&A session (Magnus on MAP, Markus on EAAT)
<b>14/9 09:00</b>	<b>Deadline case study motivation report (compulsory)</b>
<b>18/9 13-15</b>	<b>Presentation case study motivation report (compulsory)</b>
<i>19/9 09:00</i>	<i>Deadline exercise model</i>
24/9 15-17	Exercise model seminar
<i>3/10 09:00</i>	<i>Deadline case study as-is models</i>
2/10 13-15	Q&A session
8/10 10-12	Case study as-is model seminar
8/10 13-15	Q&A session
25/10 13-15	Q&A session
30/10 13-15	Q&A session
<i>29/10 09:00</i>	<i>Deadline case study scenario models</i>
1/11 15-17	Case study scenario models seminar
8/11 15-17	Q&A session
15/11 15-17	Q&A session
<i>15/11 09:00</i>	<i>Deadline recommendation justification</i>
20/11 13-15	Recommendation justification seminar
<b>26/11 09:00</b>	<b>Deadline final report (compulsory)</b>
<b>30/11 10-12, 13-15</b>	<b>Final presentations (compulsory)</b>