Abstract

The master study Systems Engineering is completed by performing a thesis project. This document describes objectives and guidelines for the project and the thesis.
Objectives of Master Project

Apply SE methods, techniques, and concepts in practice and reflect on its application, while providing value to the industrial sponsor.
Formalized Goal Statement

The goals of the Final Project are:

- the students have to prove again their professional competence and the acquired command of the systems engineering discipline by applying it to a selected problem.

- the selected problem has to be relevant in the context of the company in which the student works, so that knowledge is truly put into practice.

- to facilitate the students to make the step from “just applying” to “critical reflection”.

- to verify that students are capable to operate at academic level.
Stakeholders of the Master Project

academic supervisor
coaching
quality
grading

master project

industrial company
sponsor
industrial context
usable results

company supervisor
coaching
industrial case

student
research
paper

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academic
industrial

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Scoping is Crucial

<table>
<thead>
<tr>
<th>Question</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>What methods, techniques, tools, concepts</td>
<td>Systems Engineering</td>
</tr>
<tr>
<td>What (sub)systems, releases, functions, qualities, aspects, disciplines, technologies</td>
<td>industrial</td>
</tr>
<tr>
<td>What timing of activities and deliverables</td>
<td>planning</td>
</tr>
<tr>
<td>What resources (student time, means, advisors)</td>
<td>planning</td>
</tr>
<tr>
<td>What approach, criteria</td>
<td>research</td>
</tr>
</tbody>
</table>
Case Positioning

organizational and operational context

System 1

sub-system component component component component

sub-system component component component component

System n

sub-system component component component component

sub-system component component component component

system requirements

design decisions

parts connections

lines of code

number of details

10⁰

10¹

10²

10³

10⁴

10⁵

10⁶

10⁷
Depth, Breadth and Reflection

SE body of Knowledge

reflection

organizational and operation context
user needs and system requirements

design and realization

connect
case

organizational and operational context

System 1
sub-system
component

System n
sub-system
component

number of details

10^0
10^1
10^2
10^3
10^4
10^5
10^6
10^7

system requirements
design decisions
parts connections
lines of code

version: 1.7
May 4, 2017
SETPcaseT
Difference Academic and Industrial Goals

SE body of Knowledge

- organizational and operation context
- user needs and system requirements

**academic perspective**

**industrial perspective**

**means**

- reflection
- breadth
- depth

**goal**

- design and realization
- case
## Process of Master Project

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pick subject</td>
</tr>
<tr>
<td>2</td>
<td>Secure supervisors (NISE, industry)</td>
</tr>
<tr>
<td>3</td>
<td>Write proposal, project plan; for paper write abstract</td>
</tr>
<tr>
<td>4</td>
<td>Perform project; involve supervisors regularly</td>
</tr>
<tr>
<td>5</td>
<td>Write paper and iterate with supervisors</td>
</tr>
<tr>
<td>6</td>
<td>Present master project</td>
</tr>
<tr>
<td>7</td>
<td>Grading by academic and external assessors</td>
</tr>
</tbody>
</table>

**Graduation**

**Publication in journal or conference**
tentative dates for milestones for IM students

August

June

August

September

February

anticipating in RP how to apply

approach searching a topic

research methods prepare academic

project execution

academic writing
Master Project Milestones

- **Proposal (September)**
  - System
  - SE need company

- **Abstract (November)**
  - Academic contribution

- **Book Plan (February)**
  - Introduction
  - Check structure, style

- **Final Paper/Report (May)**
  - Presentation

Tentative dates for milestones for IM students

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Systems Engineering Master Project
11  Gerrit Muller

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SETPmilestones
Plan: Simple PERT Diagram

control system architecture and design

incremental build mathematical models, simulate various inputs

analysis and simulation f1

analysis and simulation f2

verify system performance

analyze stakeholders, requirements, analyze system concepts and context

"simple" context model, analyze system impact and adapt requirements

write phase report

report layout

write draft paper and include findings

finalize paper

analyze system impact and adapt requirements

report layout

write draft paper and include findings

finalize paper

Systems Engineering Master Project

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May 4, 2017

SETPprojectPlanPERT

Gerrit Muller

version: 1.7

May 4, 2017

SETPprojectPlanPERT

Gerrit Muller

version: 1.7

May 4, 2017

SETPprojectPlanPERT

Gerrit Muller
"A good abstract should answer three questions:

What did I do,
what did I learn,
and why is that important?

The key is to identify something or things that can be reused in the future."

Prof. Michael Pennotti, Stevens Institute of Technology
Students write an initial abstract at the start to think through what can happen. At the end of writing the paper, you write the real abstract. The academic supervisor has to accept the initial abstract before starting the project.
### Project Execution

<table>
<thead>
<tr>
<th>Task</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintain a project log</td>
<td>Data, findings, documents, references</td>
</tr>
<tr>
<td>Keep supervisors involved</td>
<td>Regular presentations, regular meetings</td>
</tr>
<tr>
<td>Time box and iterate</td>
<td>Case system and context, reflection and consolidation</td>
</tr>
<tr>
<td>Early feedback on paper</td>
<td>Start writing early, elicit feedback early, work incremental</td>
</tr>
</tbody>
</table>
1. Explanation of the subject; what is the goal of the project?

2. Positioning of the subject in the academic context and literature; what does this paper add to the Body of Knowledge?

3. How is the project performed, what has been done.

4. Evaluation of the project, reflection on the results and the project itself.

5. Paper should be submittable to a refereed conference or to a journal; the academic supervisor may accept a report as well.
1. Clearly introduce the problem that the manuscript is discussing/addressing,

2. Discuss the problem background. That is, discuss the research that has been previously conducted by you or others in the field (or related fields) to solve/address the same or similar problem,

3. Develop a succinct argument for the methods or ideas proposed in your manuscript,

4. Present a clear and understandable justification of why the proposed methods or ideas contribute to a superior or different solution to the problem. A clear statement of your contributions is often crucial to reviewers. Clear specify this when possible. And finally,

5. Discuss the likely future directions of the research being conducted by you (your group).

Final Presentation at the end of the project

student presentation of master project
~30 minutes presentation
~20 minutes questioning by examinators
~10 minutes examinators conclude

committee:

- academic supervisor
- at least one other academic staff member of SE
- external assessor
- (optional) company supervisor or representative
- at least 3 people
<table>
<thead>
<tr>
<th>Step</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company screens paper for sensitive or confidential issues, see</td>
<td><a href="http://www.gaudisite.nl/BuskerudSEpublicationProcedureSlides.pdf">http://www.gaudisite.nl/BuskerudSEpublicationProcedureSlides.pdf</a></td>
</tr>
<tr>
<td>Select target journal or conference, typical choices are:</td>
<td>INCOSE symposium, CSER, Journal of SE</td>
</tr>
<tr>
<td>Transform the paper into the prescribed format or template</td>
<td></td>
</tr>
<tr>
<td>Review of the paper by NISE and Company, adapt paper</td>
<td></td>
</tr>
<tr>
<td>Submit paper to journal or conference</td>
<td></td>
</tr>
<tr>
<td>Process journal or conference feedback</td>
<td></td>
</tr>
<tr>
<td>Final review by company</td>
<td></td>
</tr>
<tr>
<td>Submit final version</td>
<td></td>
</tr>
<tr>
<td>Visit conference and present paper</td>
<td></td>
</tr>
</tbody>
</table>
Third Party Involvement

If a third party is involved, e.g. a customer or supplier,
then ask the third party to agree with publication procedure:


and ask who will be reviewer for the third party
Submission instructions

use for all preparation deliverables the following conventions:
filename: SEMP <your name> <subject>.<version>.<extension>

e.g. SEMP John Student abstract.2.doc

where subject = {proposal | abstract | plan | presentation | paper | ...}

email to: <gerrit.muller@gmail.com>

subject: SEMP <subject>

"standard" file types preferred, e.g. pdf, jpg, doc, xls, ppt
workshop 1 in June
workshop 2 in August
workshop 3 in September
   Master Project; Writing an Abstract: http://www.gaudisite.nl/MasterProjectWritingAnAbstract.pdf
   Master Project; Execution Phase: http://www.gaudisite.nl/MasterProjectProjectExecution.pdf
Validation of Systems Engineering Methods and Techniques in Industry
Systems Engineering Research Methods (paper)
Published Master Project papers: http://www.gaudisite.nl/MasterProjectPapers.html
Workshop Academic Writing http://www.gaudisite.nl/RPacademicWritingSlides.pdf