# Requirements and procedure for doing an external master thesis at the Security Group of the TU/e

By Sandro Etalle,
Head of the Security Group – Faculty of Mathematics and computer Science, TU/e
With input of Boris Skoric, Nicola Zannone, Jerry den Hartog
Version 0.9 12/09/2016

## Disclaimer

This document does not necessarily reflect the view of my TU/e colleagues, but it constitutes the vision and the policy of the Security group of the M&CS department of the TU/e (in short: SEC)

## This document is for

- Students, who want to do a Master thesis at a company, rather than at the TU/e on the topic of computer security (that is, master thesis for which the TU/e supervisor is a member of SEC)
- Companies who want to have students carry out a master thesis at their premises on the topic of security (that is, master thesis for which the TU/e supervisor is a member of SEC)

## Motivation

Doing the master thesis at a company, rather than internally at the TU/e, can be beneficial for the student, for the company and for the relationships between the University and the company.

However, external master theses lead to difficult situations much more often than I wished. For instance, the student often risks not to finish in time, or to deliver something that is not as good as it should be. The main cause seems to be that external companies often do not realize what the student should accomplish to finish his/her master thesis, while the TU/e supervisor has little control of the student, who eventually has difficulties finishing the job.

Because of this, I am personally very reluctant to be the internal reference of an external master thesis unless I personally know the external supervisor. This is however suboptimal.

I have written this document to facilitate the life of the student who is doing an external thesis, and of the company hosting him/her and of the TU/e lecturer who has to do the local (TU/e) supervision. It contains the minimum information the student and the company should know, and it is important that both the student and the company supervisor commit to the procedure described here before the start of the thesis.

## The Ingredients of a Master thesis

First it is important to realize that a Master thesis typically consists of
- A well-formulated **scientific question**
- A (possibly partial) **solution** to the question, which is typically an artifact, e.g., a computer program.
- A **validation** of the solution. This part is often "forgotten", but it is crucial: the student must show that his/her solution actually solves the problem at hand. This can be done e.g. with experiments or with a theoretical proof. Often, this part requires a comparison with other systems in the literature, showing that the solution designed by the student is "better" than existing ones.
- **The writing of a high quality essay**, with a proper introduction, a proper literature study, a proper description of the solution, the validation, proper conclusions and future work.

All this has to be done within 6 months. An extension to 9 months is usually no problem, but extending beyond the 9 months is almost impossible, and the risk is high that the student may have to change subject and supervisor (TU/e regulations).

As you see, there is very little time, therefore: **by taking a master student, external companies take the responsibility of providing proper supervision and guidance to the master student.** There is too little time to work otherwise.

To this end, a Master student doing an external master thesis must have two supervisors:
- The main supervisor is the "Company Supervisor": a company employee.
- the "TU/e Supervisor": a TU/e employee who takes cares of checking the quality of the work

Since most of the work is done at the company, the Company supervisor must **take the responsibility** of providing appropriate supervision to the student. This person
- monitors at least weekly the progress of the student and **makes sure that the timeline is met (key milestones described below)**;
- has enough domain knowledge to guide the student towards the selection of a suitable methodology and to indicate what the current state of the art (literature) is;
- is able to guarantee the availability of the data/instrument/facilities (if any) that are going to be needed to carry out the validation of the solution;
- knows what it is to supervise a Master thesis: he holds a MSc or a PhD degree.

## The timeline of a master thesis

To make sure that the work is done properly and carried out the student and the company supervisors together commit to the following timeline

a. At day 0: answer the Initial Checklist below. This is a go/nogo check.
b. Within one month: a draft of chapter one of the thesis should be ready and presented to the TU/e supervisor. This includes the introduction to the topic and a proper description of the (scientific) question at hand. This is a go/nogo check.
c. Within two months: a draft of the literature study is ready and presented to the TU/e supervisor. This is a go/nogo check.
d. Three to four months: the solution is ready and presented to the TU/e supervisor.
e. Mid-term presentation: sometime around the 3-months milestone the student should make a presentation at the TU/e illustrating the progress.
f. Around month 4: the solution is validated
g. Last 2 months: writing of the thesis.

**Initial Checklist** to be answered by the student, in cooperation with the Company Supervisor.

1. What is the topic of the thesis?
2. What is the scientific question?
3. Which methodology are you going to use to tackle the scientific question?
4. What are you going to deliver (which kind of results)?
5. How are you going to validate your results?
6. Which data/tools/instruments do you need to validate the results?
7. Are the data/tools/instruments already available?
    a. Who is in charge of them at the company?
    b. If you need data:
        i. How much data do you need?
        ii. How much data is available?
        iii. Who is responsible for the data at the company? Has he/she already committed to making the data available?
        iv. How do we deal with the privacy regulations?

8. Who is the Company Supervisor?
9. How frequently is the Company supervisor going to meet the student?

**Explanation regarding point 5**. It is important that you have a good idea how you are going to validate your solution and that you make sure that the data/instruments/facilities required for the validation are available **before you start the thesis**, with the appropriate permissions in place. *For instance, for a thesis on intrusion detection, you would need to have lots of data to check the false positive rate, enough realistic attacks samples to check the detection rate, and you would need to have access to other IDSs in the literature (you may have to compile them from scratch from the algorithms). Where it often goes wrong is that (a) the company provides no data due to confidentiality/privacy (b) there are no sample of*

*attacks – often because the company does not really know what they are looking for, so there is no threat model.*

## Examples of recipes for disaster (still draft)

- Company to Student: "You come here and do whatever you want", which is just as dangerous as "Define your own project". If this is the starting point then there is no added value in doing the thesis at the company and most likely there is also no one at the company able to supervise the student properly. The unguided student usually wastes too much time now really knowing what he wants, let alone how to achieve it.
- Company to Student: "Find anomalies in this dataset". My following question is "what are you looking for?", if the answer is "anything" or "I don't know" then I know this is not going to fly…