Making Master Thesis: What, Why and When*

PART I: Philosophy and Some Practical Issues

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Abstract

This document is short, imprecise, but nevertheless (hopefully) a helpful "living document" that tries to answer some questions related on making a successful M.Sc. (diploma) thesis. It is **not** designed to be a strict cookbook (or a collection of orders) unless something is specifically noted as such.

1 Introduction

If you are reading this document you are thinking about to start to make your M.Sc. thesis, or have already embarked on the task. This document has a very narrow scope and it deals only with the certain aspects of thesis writing and research that are mostly unique for our environment. For more general information you should ask around, and there are also general books and documents available that you could consult (some of those will be mentioned later).

1.1 Pedagogy, What and Why?

The thesis work is a traditional part of your curriculum. Perhaps the easiest answer to question why you have to write thesis, is to point out that you are required to do so by the curriculum (your DPO or MPO) [4]. However, there are even justification for this.

We refer thesis in this document as M.Sc. (Masters) thesis, although in German curriculum it is known also as diploma-thesis. These terms are interchangeable, so it does not really matter. The formal definition for a thesis could be *"a treatise advancing a new point of view resulting from research."*[1]

The thesis is sometimes thought to be a *formidable*[2] task by students. However, there are some important issues one has to understand about M.Sc. thesis;

- The requirements for a M.Sc. thesis are lower than for a Ph.D. thesis. Hence, although you might work with a genuine research problem, you are not expected to produce *alone*, *substantial* new scientific knowledge during your M.Sc. work.

*This version is a draft (v0.65).

[1] As unnecessary footnotes are nice we give also a partial quotation form Oxford English Dictionary [**?**]: thesis: *in Logic, Rhetoric, etc.* **1**. A proposition laid down or stated, esp. as a theme to be discussed and proved, or to be maintained against attack (in Logic sometimes as distinct from HYPOTHESIS 2, in Rhetoric from ANTITHESIS 2); a statement, assertion, tenet. **2**. A dissertation to maintain and prove a thesis (in sense 1); esp. one written or delivered by a candidate for a University degree.

[2] formidable sometimes as "hard", "impossible" and "scary"

- The M.Sc. thesis is something that could be thought to be a blend of ”exam, project and education”. What do we mean with this? It has a certain element of ”exam”, since you will get evaluated (including a grade). Not only that but you are supposed to show that your *own* contribution is substantial; you have written it completely yourself etc. Hence, since you are evaluated by your thesis it has a certain element of exam in it. However, one should not be blinded by this simplified point of view. It is also a project, in a sense that you are required to work a lot of time (that is six months) with the research problem. You need to plan with your supervisor time-table and required work items for the thesis. This is most probably an iterative process.

  Thesis is never ”just” about writing something, it is very much of conducting a small R&D -project and then reporting results. As it is a project, you are not supposed to be alone. You are allowed discuss about your problems and research with others. In many cases there are other people around you working with similar topics, and it is completely all right to ask around and exchange ideas. Most importantly, you are allowed and encouraged to interact with your supervisor(s). Although you are supposed to show *independence* that does not mean that you should do everything alone and without asking reasonable help and guidance. Finally, it is still *education*. For many people M.Sc. thesis is the first time to conduct independent research work and to write up a lengthy thesis document. It is a rite of passage, but it is not there without reasons[3]. The reason is education, you should learn to work independently and should demonstrate ability to report on your work. Since you have not, yet, done this sort of tasks before, it is about to learn it. So there are educational reasons to demand this from you. Because it is education, we we will be also helping you to get started and also push you to finish if so needed.

The requirement of the thesis work gives you an opportunity to focus on the single subject area, develop work items within it, carry out research work, and document it in a reasonably comprehensive manner called ”M.Sc. thesis”. There are different thesis topics and levels. The excellent thesis work typically have a creative component and clear individual responsibility is shown. The thesis work itself might be a design project, analytical (mathematical) work, or experimental project, quite often it has all of these elements in varying degrees.

However, we want to stress that there are different ways to break the egg. Some of thesis work have more theory, some are quite practical. The level of independent work varies etc. This makes working with M.Sc. thesis challenging, but it is also a fun part.

1.2 Requirements

The prerequisites for the thesis are quite clear for RWTH students, and in most parts they are applicable also for exchange students. The thesis is your ”swan song”, i.e. it should be one of the last things you do in the university towards your Master’s degree. Hence, in general, all the course work needs to be done (see details from the study plan), and if you are RWTH student you should have completed your *internship* before starting thesis. If you are reading this document you probably already knew that.

We expect that you have necessary background in the communications networking and/or wireless networking. There are no formal course prerequisites, and we discuss

[3]Reasons is also not because earlier generations had to do it. Neither because someone wants to put you to work on useless stuff.

individually with all students on the topic and required background. Nevertheless, it is assumed one has *general* background, but one needs to read a lot in the beginning of the thesis work to acquire *specific* knowledge.

The matriculated students **must register** for thesis work with the central administration. This is done through a specific form. The form requires signature from the supervising professor, and title of the topic (both in English and German). You can ask help from the secretary and assistants around. The signature and title can be agreed ”dynamically”, but do not leave that to the last possible moment. There is one **specific and important** point on the registration; the signatures from professors signing it will start your *”thesis clock”* (see below).

The requirements and limitations for the thesis work itself are;

- You will conduct sufficiently independent research which will include theoretical, experimental and/or design parts.
- You will produce M.Sc. thesis that is written by yourself and shows that you have capability of reporting you work in concise and ”stylish” form. The thesis is **not** simply a report of your own work, but it should also give enough background from the field. It should give ”a state-of-the art”, i.e. setup your work to wider context.
- You have six (6) months to do this work. Note that this is **not** negotiable. In the extreme case you can ask a short extension for your working time, but this needs to be done formally from the faculty, and it would inevitably affect to your grade[4]. The part of the job is to stay within time-line, and plan your work well enough. Discuss about timing with your supervisior(s), there are definitely there to help you to be clever. The *thesis clock*, i.e. the six month period, starts to run from your registration date.
- As a basic rule the thesis work is done in the laboratory (group, department) of the RWTH Aachen. There are some (rare) exceptions. The main academic supervisor is always a professor from RWTH Aachen, there is **no** exception for this.

  Finishing within time requires a special comment. If you are *really* going to miss the deadline not by hours or few days, but by weeks or more, it is time to really sit down with your supervisor (including academic staff level supervisor) and discuss on what can be done. This sort of problem needs to be settled firmly and quickly, hence sooner you talk about the ”time-problem” the better.

2 Time-line, intermediate steps and all that

As you are reading this document you most probably have done the first step of the process. The first step being to find a suitable topic and supervisor(s). There are, however, few caveats you need to understand even on this issue;

- Topics are not written in to the stone. Hence, you should be able to negotiate on the specific topic issues before you start the work (this you already know, don’t you). But you are also allowed to discuss about the exact line of the work, and

[4]Unless the reasons for extension is ”force majeure” such as a serious illness. As a basic rule, do not plan to go over your deadline.

content also during your thesis period. It is clear that as your work progresses and your skills get better, you will see a new avenues or you will find out that something is impossible. Naturally you are allowed to discuss about changing the detailed course of the work within tolerance. So be communicative, this sort of discussion is most often seen as a positive indicator, not as negative. However, as the time is limited you do not have time to make major focus shifts too many times.

- Why it is supervisors and not the supervisor? There is always academic senior staff member as your supervisor this is inevitable. However, depending on your topic it is either mostly only this senior person who is supervising you, or there are other people who will give you more day-to-day support. Quite often you have a ”secondary” supervisor helping you, and this is typically Ph.D. student who is working on that area. This is most often a positive step, since they have more time on helping with specific and practical problems. Remember also that for some pressing practical problem you might find answers even from other M.Sc. students.

The last point requires some extra comments. If you have a Ph.D. student as your co-supervisor, you should not be confused that an academic staff member is not interested in to know how your work goes on. Through your co-supervisor, but also directly, keep him or her informed in how things are going on. Let him or her know how well you do (remember it is the staff members who will be in the last stage evaluating you, and those are the people you rely on getting that nice recommendation letter). So this is an opportunity to get to know him or her as a person and not as a lecturing ”talking head”[5]. However, more senior people are more busier they tend to be. So there are some practical limits on how much face-to-face time you will be able to get.

In ”MobNets” all the supervisors typically fall into the category of ”approachable” and talkative. The general time-line recommendations one can give are (but this depends always between people and thesis work);

1. You should have at least one formal face-to-face meeting with all your supervisors before your formally start your thesis (i.e. start your ”thesis clock”). In this meeting the rough agreement on the goals and topic should emerge. Quite often it also leads to a draft ”list of contents” being drawn up. The list of contents typically is no more than understanding on ”chapters” and ”some sections” which would go into the thesis. Many students find this a good starting point, but naturally as your work is progressing there will be adjustments and ”tweaking” of the contents.

2. You should aim at to keep your ”day-to-day” supervisor updated on your progress regularly. It is hard to give any ”rule”, but old ”Oxbridge” rule of thumb was saying that if your day-to-day advisor does not hear anything about you within 2-4 weeks, something might go wrong (of course, this depends). You should keep your senior supervisor also updated within reasonable limit, sometimes it can be also agreed that your day-to-day supervisor reports to academic staff member. But direct contact occasionally is good (see also next point).

[5]However, be forewarned, there are different level of interactions between academic members. In some groups the senior academic members like to interact a lot with the M.Sc. students – up to the point that you are trying to escape them and not the other way around. In some other groups senior members might not have time or willingness to interact so much. So you have to adapt to whatever conditions are prevailing

3. You should report to your senior academic supervisor on the progress *at least* once, this should be a short progress report (not necessarily written one[6]) and you should aim at to do that *no later* than two to three months after starting. Quite often, this requirement is done informally and automatically, but if not, it is good advice do it. The progress check point is **not** an examination, it is simply educational and pedagogical trick to ensure that everything is progressing as it should be. The mid-point review will not affect your final grade.

4. You should start to write-up your results and review part of the thesis sooner than later. In any case, you should have fragments of thesis ready *at least* a month before the deadline. Use your supervisors and these fragments! Typically it is no good to sit over your text to the last minute and then submit them. Well, there is no rule against it, and some people have done it *very* successfully. But you can definitely show your text to your supervisors to get ”early and rough” feedback. They can quickly spot many typical errors (constructional or stylistic) and tell you what to do.

   The ”early and rough” does not mean that corrections are necessarily detailed ones, but usually you will find out them useful. Remember that this *early commenting* is a part of supervision, so they do not tend to affect to your grade. Before you submit formally ”the final” (or in reality the 2nd to final) version, the ”older people” are there to help you. The final submission forms the main part of your evaluation, but note that it is not only a thesis anyway that will affect how good you look.

5. Final submission(s). You should aim at to give ”the almost final version” at least about a week before the deadline to the professor (again you can discuss on details and this depends as we are always saying in this document). There is a good chance that you get some suggestions back relatively soon. The final submission should be done no later that during the agreed deadline day. Note that although this is the final submitted version for the formal check-up, you should not run up to print out 1,000 copies for all your relatives and friends. Again most probably you will get back comments and suggestions to make some minor corrections, before it is declared ”closed”.

6. Presentation. You should aim at on agreeing the presentation day (”oral examination”, ”public talk”, ”viva”, this has many names in the world) as early as possibly. It can be, if possible, during the deadline day. However, often it is slightly later than your submission deadline, most often it is arranged to happen as a *Friday Seminar* at the department of wireless networks. This is somewhat of tradition. You are allowed to bring guests for your talk. There is also some traditions related to aftermath, ask from ”older people” or the secretary on that issue, if you are not already knowledgeable (most probably you are automatically quite knowledgable in the end of your master thesis work period).

2.1 Some Notes on Time-Plan

Part II of this document (which is more practical) will be rehashing issues we will rise below, but nevertheless it is useful to stress few practical issues.

[6]There is exception for this; if you are some reason working mostly outside our laboratory the progress report should be written and include a slide deck on the main issues. The review is more formal in this case, since we want to make it sure that strict quality and quantity requirements will be met.

The actual writing takes always more time than you believe. This is not the typical essay thing, do not leave writing to last night. Well, we did not think you would, but do not leave that even to last few weeks. Sooner you start the better. In fact, it is best start to as soon as possible, since then you will learn faster how hard it is to produce good quality text[7] Early starter will have more time to polish, and you will soon find out your personal speed. Only in the very rare cases people have been able to write the whole thesis and polish it in a shorter period than one month.

Note also that there are ”editorial delays” and writing delays. Students can be frustrated when they hand in a chapter or two for commenting and do not get anything back next day. Remember that although you have a privilege and duty to concentrate on single job (of getting your thesis done), your supervisors do not have this position. Hence, although from your perspective something that took from you few hours to write, should be commented back asap, might not happen so. If you need feedback plan ahead, if it is *really* urgent say so to your supervisor. Being warned on the ”scalability problem”, the fact is that typically you will get feedback relatively quickly, unless you were dropping hundreds of pages of illegible documents to comment.

Sometimes *starting the writing* is harder than the writing itself. Also because of this you should start your writing work as soon as possible. There are a lot of different solutions to force oneself to write; and writer's block is a problem even for the professional authors. You have to find what suites best to you. Some people need inspiration, some need to setup specific time and place (”I start every day at 9 a.m. in the library to write up my results” -solution) to force themselves, and some others need hot chocolate to free their mind. Experiment and find what works with yourself. One good and classical way is to write up a short summary (maybe a bullet point list) for what you plan to write next. Then you just follow your ”synopsis”, and when you have reached the planned stage, you stop.

Think thesis overall as **project**. Make a plan and schedule, force yourself to be your project manager. Discuss about your schedule with other students (especially Ph.D. students are good victims for this, as they have a recent experience on how much it takes to accomplish different things) and supervisor(s). Make sure that your time-plan is realistic, remember your deadline – and let us once more remind you that the supervisor typically expect to see a first draft of the thesis well in advance of the deadline.

3 Avoiding Delays and Some Other Known Problems

There are many known problems that you should be available. In the following we list some of those (this list is adopted in part from [1] and [2]);

1. **Unavailable material** If your work is experimental you might miss some important components, and even in the case of some more theoretical work you might miss data (that missing cd-rom full of cellular network data). Plan well ahead. If the issue persists, try to find alternate sources and solutions. In any case, do not wait passively. Do some other aspects of your thesis work, and do let your supervisor(s) to know. If they do not know about the problem, they will not be able to help or adapt.

2. **That another person disappeared**, i.e. your work might be dependant of getting something from other people. You should note that people have different

[7] You should read good quality text like ”good quality and easy to read text”, not like this document.

time-lines, and especially if it is Ph.D. student or faculty member with whom you are collaborating their understanding of time-scale might be *hugely* different[8]. Try to anticipate this and work around the problems. Note that this will happen to you most probably also in the industry or academia yet-another-time, or the first time, if you are lucky enough to escape this problem during your M.Sc. work. Again if problem persist, you should try to find alterative solutions, or discuss with your supervisors etc.

3. **The Incredible Expanding Thesis**. The thesis work is evolving larger and larger as you progress. This is natural, but there should be some limit. If this is due to you (”I want to solve all the problems in the world” -syndrome), discuss with your supervisor how to limit work without losing your ambition to produce that ”incredibly good thesis”. If this is due to your supervisor or Ph.D. student helping you (”My student should solve all the problems in the world that I did not solve” -syndrome”), then negotiate diplomatically.

4. **The disappearing supervisor who hates me**. The more senior your supervisor has more duties and other commitments they tend to have. Hence, sometimes you might feel that you are ”alone”. Some students might misinterpret this as a firm sign that the supervisor has lost patience. This is not typically a case, and your should not react by disappearing yourself. Typically supervisors want to be kept informed (within tolerance), write notes, send email (see other discussion in this document) *within* reasonable limit. In the extremely case that supervisor has been really sucked by the black hole, or he/she really hates you, it is time to discuss alternative solutions.

References

[1] MIT, *The Masters of Engineering Thesis Guide 2004-2005*, Department of EECS, MIT. Available on line ”http:\\www.eecs.mit.edu/ug/thesis-guide.html” (visited 05/2005).

[2] Mähönen P., *Curious Thoughts and Internal Memo on Why Things fall apart in Thesis Projects*, not published but might be available for people wanting to waste time.

[3] *Oxford English Dictionary*, Oxford University Press, 2004.

[4] *private communication* with Frank Oldewurtel in May 2005.

[8] Especially senior faculty members might be difficult – like to one of the writers of this – I am senile enough that the next year is a close enough approximation for the next week. Well joking, of course, but you are forewarned again on scalability.