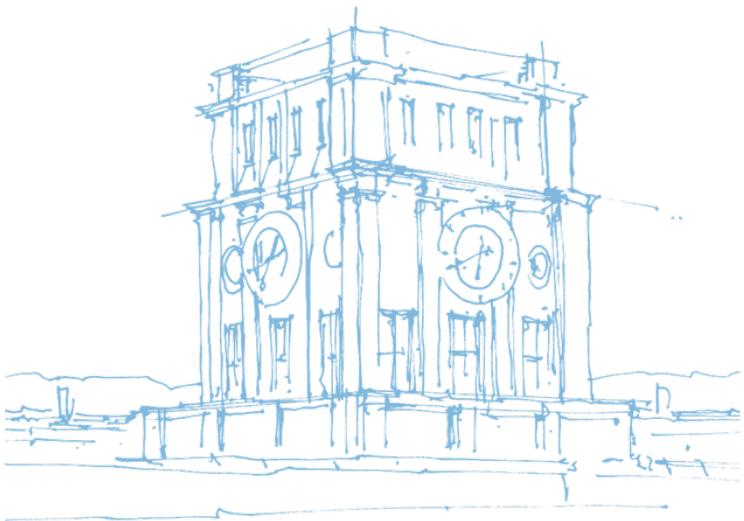
Chair of Network Architectures and Services
Department of Informatics
Technical University of Munich

Bachelor and Master Thesis How-To

Dr. Holger Kinkelin

Friday 9th November, 2018

Chair of Network Architectures and Services
Department of Informatics
Technical University of Munich



Nota Bene

- The slideset at hand is a subset of lecture slides originally intended for (pro)seminar students.
- By this reason, the word “paper” is typically used when referring to written work.
- However, all information provided is valid for BA/MA theses or other student works as well.

Thesis

- Structure of BA/MA Theses and Conference Papers
- Advice for BA/MA Theses

Talk

- Advice for Slides and Talk

Thesis

Thesis

- Structure of BA/MA Theses and Conference Papers
- Advice for BA/MA Theses

Talk

- Advice for Slides and Talk

Structure of BA/MA Theses and Conference Papers

Thesis Types

We differentiate between the two most common types of theses:

- “Systemic” Theses
  - Goal is the creation of a new system or the improvement of an existing one.
  - Layout follows the waterfall model of software engineering.
- “Measurement” or “Analytical” Theses
  - Goal is to gain new insights about an existing system by performing experiments or measurements.
  - Layout has similarities with “systemic theses” but focusses on the evaluation of measurement values.

Structure of BA/MA Theses and Conference Papers

Structure of a Typical Conference Paper and BA/MA Thesis

- Abstract (Kurzfassung)
- Introduction/Motivation (Einleitung)
- Body[1] (Rumpf)
  - Background (Grundlagen)
  - Analysis (Problemanalyse)
  - Design (Lösungsdesign)
  - Implementation (Implementierung)
  - Evaluation (Auswertung)
  - Related Work (Verwandte Arbeiten)
- Conclusion (Zusammenfassung)
- Literature/References (Literaturverzeichnis)

→ Each of these sections has a distinct purpose.
→ You have to meet the expectations of your readers!

[1] Variations possible! This is the most common way used to describe newly created systems.

Abstract

The abstract summarizes the most important facts presented in the paper/thesis:

- What is the problem? Why is this problem important?
- What is the idea/approach described?
- What are the most important contributions?
- What are the advances compared to the state of the art?

$\rightarrow$ After reading the abstract, the reader knows what she can expect from the paper/thesis and decide if she wants to read it entirely.

Structure of BA/MA Theses and Conference Papers

An Example Taken From the Conference on Really Bad Ideas

"This paper addresses the problem of BrandX engines not meeting emission standards. This has disadvantages as people will buy less BrandX cars.

Therefore, this paper presents the approach to cheat during emission tests.

As major contributions we designed a software package that tweaks the engine control system of BrandX cars when it notices that exhaust gases are analyzed. When tweaked, the engine will produce less power and consequently emit less CO_2 and NO_X.

The solution presented in this paper offers significant advances compared to designing a proper engine as it is much faster and cheaper to realize."

Structure of BA/MA Theses and Conference Papers

Introduction/Motivation

The introduction repeats some aspects of the abstract and adds new ones:

- What is the problem? Why is this problem important?

  Some more details as in the abstract. However, no technical analysis!

- What is the idea/approach described in the paper?

  Some more details as in the abstract.

- What are the most important research questions that we answer?
- What is the structure of the rest of the paper?
  - "The rest of this paper is structured as follows: Chapter 2 presents background information needed to understand the problem analysis, c.f. Chapter 3. In Chapter 4 we, ..."

Conclusion

The conclusion repeats some aspects of abstract and introduction but focuses on contributions, findings and insights:

- What was the problem?
- What are the most important contributions of the paper?
- Why do these contributions answer the research questions?
- What are the advances compared to the state of the art?
- Is there some especially important lesson that we learned?
- Often: Outlook on future work

Summary for so far

- The abstract can be seen as a shortened version of the “sum” of introduction and conclusion.
- Abstract, introduction and conclusion overlap.

- Abstract, introduction and conclusion are quite short sections that contain the most important things described in the paper.

→ Write those sections with greatest care and at the end.
→ It is a good idea to check whether all information is aligned.

Structure of BA/MA Theses and Conference Papers

Body I

The structure of a paper describing the creation of a new system or the improvement of an existing one resembles the waterfall model known from software engineering:

- Background
  - Presents additional info the reader needs to know to understand the rest of the paper.
  - Does not analyze the background tech w.r.t. the problem!
  - E.g.: What is the scenario we talk about? How does protocol X work?
- Analysis
  - Delves into details of the problem by carefully analyzing its (technical) causes.
  - Analyzes requirements on a suitable solution.
  - Analyzes and assesses several possible approaches that solve the problem.

Structure of BA/MA Theses and Conference Papers

Body II

- Design
  - Presents details of the chosen approach.
  - E.g.: System architecture, message sequence diagrams, ...
- Implementation
  - Presents selected implementational details.
  - E.g.: Functional components, class diagrams, ...
  - $\rightarrow$ Do not mix design and implementation chapter!
- Evaluation
  - Assesses if the found solution is suitable to address the stated problem, i.e., is the new system good/the improvement significant?
  - E.g.: Performance or security analysis, comparison to requirements, ...
- Related Work
  - Presents the work of others and compares it to own work.

Related Work

The related work chapter sometimes causes difficulties:

- There is nothing entirely comparable!
  - Find solutions to a similar problem used in a different scenario.
  - Find solutions that are partially comparable.
- Where to place the related work?
  - Three places are quite common: after motivation, after background, after evaluation.
  - There is no right or wrong solution; it depends on the thesis.
  - Place the chapter after motivation or background to stress the need for your work, e.g., no solution for the problem exists.
  - Place it after the evaluation to stress that your system does something better than existing systems, e.g., this solution scales much better.

Structure of BA/MA Theses and Conference Papers

Alternative Body I

The structure of a paper targeting the evaluation of an existing system by measurements/experiments has a similar structure. However, the purpose of each section differs slightly and the focus is on the evaluation.

- Background
  - As described before.
- Analysis
  - Delves into details of the system to experiment with.
  - Analyzes which parts of the system are relevant.
  - Analyzes different methods/experiments how the system can be evaluated/measured.

Structure of BA/MA Theses and Conference Papers

Alternative Body II

- Design
  - Elaborates in detail how the experiment is conducted, i.e. a software component able to perform the experiment is designed.
  - E.g.: Sequence diagrams describing the experiment, test setup, etc ...
- Implementation
  - Presents selected implementational details about the software component performing the experiments.
  - Presents details about the test bed or experimental setup
  - $\rightarrow$ Do not mix design and implementation chapter!
- Evaluation
  - Interprets the results from the experiments conducted.
  - Goal: gain new insight into the behavior of an existing system
- Related Work
  - Presents the work of others and compares it to own work.

Advice for BA/MA Theses

Language and Style I

- Accepted languages: German or English

- Avoid spelling and grammar flaws.
- Avoid colloquial language or “slang”.
- Avoid novel-, essay-, and diary-“style”.

- Write in rather short and easy to understand sentences.
- Define abbreviations upon first usage.
- Paragraphs are typically short and contain one idea/argument/...

$\rightarrow$ Write as clearly as possible.

Advice for BA/MA Theses

Language and Style II

- German personal pronouns “ich” or “wir” are uncommon.
  - Wrong: “In Abschnitt 5 präsentiere(n) ich (wir) Grundlagen...”
  - Correct: “Abschnitt 5 präsentiert Grundlagen...”
  - Correct: “In Abschnitt 5 werden Grundlagen präsentiert...”
- In contrast, in English it is quite common to use “we”.
  - Correct: “In section 5, we present background information...”
  - Correct: “Section 5 presents background information...”
- The usage of “I” is possible but also quite uncommon.
  - Okayish: “I contributed a new mechanism to...”
  - Correct: “The author contributed a new mechanism to...”

Advice for BA/MA Theses

References

- There are two types of references:
  - internal references
  - external references

Advice for BA/MA Theses

Internal References

- When you refer to a section, figure, table, or formula in your document, you need a proper text reference!
- Wrong: “Below we present background information...”
- Wrong: “On page 27 we present background information...”
- Each of the named elements needs to be enumerated e.g., figure 3, section 5, section 7.1.3.
- Correct: “In section 5 we present background information...”

- This is quite simple to achieve in LaTeX:

```
In section \ref{sec:back} we present background information...
...
\section{Background}
\label{sec:back}
```

- Each figure, table, formula MUST be explained and referenced in the text.

Advice for BA/MA Theses

External References I

- When you write about...
  - an existing protocol,
  - some basic technology,
  - related work, ...
- you MUST reference the source where you got your information from.
- Main reason: the reader might want to get additional info or check what you wrote.

- Wrong: “In their paper “On milk and cookies”, published in 2015, Ernie and Bert discuss the importance of cookies.”
- Correct: “In [5] the authors discuss the importance of cookies.”
- Even better: “Cookies are more stress-relieving than peanuts.” [5]

BibTex Helps Handling External References

- Reference “handles” (e.g., “In [26] the authors describe...”) and the literature list entry are handled by BibTex.
- Typically you have a .bib-file in your LaTeX project that contains data structures like this one:

```
@inproceedings{owningxen1,
author  = "Rafal Wojtczuk",
title   = "{{Subverting the Xen Hypervisor}}",
publisher = "Presented at the 2008 Black Hat Conference, Las Vegas, NV",
year    = 2008,
month   = {Aug.}
}
```

- To use this literature reference, just add in your text

```
In \cite{owningxen1} the authors describe ways to ...
```

- Entry generated by BibTex in the literature list:

[26] Rafal Wojtczuk. Subverting the Xen Hypervisor. Presented at the 2008 Black Hat Conference, Las Vegas, NV, Aug. 2008.

Editing the .bib-File

- Creating .bib-file entries manually is a little tedious.
- Alternatives:
  - Sites like Citeseerx, Google Scholar, ACM, Springer, ... provide BibTeX structures for papers.
  - There are many online BibTeX editors/generators.
  - For books there is http://www.ottobib.com
  - There are also (free) tools for literature, note and reference management, e.g., Mendeley, Jabref, Bibdesk, ...

Advice for BA/MA Theses

External References II - Quotes/Citations

- You may add content from external sources to your paper:
  - Definitions
  - Statements (quotes) of somebody
  - Figures
- You MUST add a correct citation to avoid being accused of plagiarism:
  - Mark text as a quote.
  - Provide a proper text reference.
  - E.g.: Bert states in [5] that *“cookies are great!”*.
- Please note:
  - Filling pages by quoting entire paragraphs is no plagiarism but still no valid work . . .
  - For reasons of print quality it is often necessary to redraw figures. You still need a reference!

External References III - Websites

- Websites are quite dynamic and might be subject to changes.
- Add the date of your (last) access to the web page's URL.

```
@MISC{treachcomp,
author = {{Richard Stallman}},
title = {{Can You Trust Your Computer?}},
year = {2002},
note = {Available online at \url{http://www.gnu.org/philosophy/can-you-trust.en.html};
last accessed on 2013/07/09.},
}
```

- Result:

[34] Richard Stallman. Can You Trust Your Computer?, 2002. Available online at http://www.gnu.org/p you- trust.en.html; last accessed on 2013/07/09.

External References IV - Extensive Sources

- In some situations referencing an entire book or RFC is not good enough.
- Add further info to help your reader in finding the relevant part of the referenced text: the page or section number.
- Note: page numbers are sometimes ambiguous or unavailable. Better use a section number!

```
... as Stallman described in \cite[section 1.2]{treachcomp}.
Furthermore, \cite[page 134]{somehandle} stresses ...
```

- Result:

... as Stallman described in [34, section 1.2]. Furthermore, [103, page 134] stresses ...

Talk

Advice for Slides and Talk

Talk vs. Paper?

- A talk is an invitation to read your work (= paper/thesis)!
- The time given is typically not enough to cover everything in detail. But you don't have to.
  - Give an overview of your work.
  - Dive into the most important/interesting aspects.
  - When you have to talk about background, only pick out what is needed.
  - Try to simplify things without dumbing them entirely down. When necessary, people can read details in your paper/thesis.
  - Tell people when and why you skipped over things, refer to your work.

Advice for Slides and Talk

Talk and Slide Structure

- Typically, the talk's structure follows the paper's/thesis' structure.
- There are "mandatory" and "optional" slides:
  - Title page: title, author/speaker, affiliation, date...
  - "Teaser" slide: problems/contributions (optional!)
  - Agenda: structure
  - (Body of talk.)
  - Conclusions: summary/most important contributions
  - "Questions"-slide: speaker's name, mail address, twitter, ...

Advice for Slides and Talk

“Teaser”-Slide

- Some speakers try to grab the audience’s attention directly after being introduced using a “teaser” slide.
- The slide’s title might be “overview”, “outlook”, etc.
- The slide gives a very quick glimpse on the problem and the contributions of the talk.
- Goal: The audience has a very basic understanding what the talk will be about.

Advice for Slides and Talk

“Agenda”-Slide

- Provides an overview on the talk’s structure.
- Mistake #1: speakers summarize their talk. Not here! Not yet!
- Mistake #2: speakers spend way too much time with this slide.
  - Especially when you have a standard structure, don’t waste your precious time!
  - However, when your talk has an uncommon structure, it is a good idea to spend some time here!
    $\rightarrow$ Tell the audience what you want to achieve in which section.
- Goal: The audience understands how our talk is structured and what you want to achieve with the talk.

Advice for Slides and Talk

“Conclusion”-Slide

- Typically, even the sleepiest person in the audience will listen when conclusions are presented.
- This is your chance to summarize your talk, ...
- ... to point out what you think is most important, ...
- ... to point out your most brilliant ideas, ...
- ... to point out the lessons you have learned.
- Goal: Even people who got lost, should get a very easy to understand summary of your talk.

Advice for Your Slides I

- Understand slides as something that will assist you. Don't build slides that replace you:
  - Don't use whole sentences on slides.
  - Catchwords are typically enough[2].
    $\rightarrow$ Otherwise people might start reading and won't follow you anymore.
- In general, you need to explain everything on the slide.
- Less is more:
  - Don't overcrowd slides.
  - Don't use too many bullet points.
  - Don't use too deeply nested bullet point lists.
    - More than two nesting layers are typically not needed.

[2] That is a typical problem of lecture slides as they try to serve two purposes: talk slides + lecture notes...

Advice for Your Slides II - Slide Titles

- Use well thought of, useful/helpful slide titles!
  - Wrong: “Background”
  - Correct: “Background: The Session Initation Protocol (SIP)”
  - Wrong: “Analysis”
  - Correct: “Analysis of SIP Security Problems”
- Headline capitalization (English only):
  - I am a proper headline written in English
  - I am a Proper Headline Written in English, too
  - No matter which option you prefer, be consistent!

Advice for Slides and Talk

Advice for Your Slides III - Figures, Animations, etc.

- Figures are great tools for your talk. Use them when ever possible.
  - Scenario, architecture, functional components, ...
- Animations help explaining complicated processes.
  - Protocols!!
  - When using PowerPoint: don’t use fancy effects, fade-in/out is enough.

Advice for Slides and Talk

Advice for Your Slides III - Figures, Animations, etc.

- Figures are great tools for your talk. Use them when ever possible.
  - Scenario, architecture, functional components, ...
- Animations help explaining complicated processes.
  - Protocols!!
  - When using PowerPoint: don’t use fancy effects, fade-in/out is enough.
- Sometimes it is a good idea to insert text/bullet points bit by bit.

Advice for Slides and Talk

Advice for Your Slides III - Figures, Animations, etc.

- Figures are great tools for your talk. Use them when ever possible.
  - Scenario, architecture, functional components, ...
- Animations help explaining complicated processes.
  - Protocols!!
  - When using PowerPoint: don’t use fancy effects, fade-in/out is enough.

- Sometimes it is a good idea to insert text/bullet points bit by bit.
- But do not exaggerate that.

Advice for Slides and Talk

Advice for Your Slides III - Figures, Animations, etc.

- Figures are great tools for your talk. Use them when ever possible.
  - Scenario, architecture, functional components, ...
- Animations help explaining complicated processes.
  - Protocols!!
  - When using PowerPoint: don’t use fancy effects, fade-in/out is enough.

- Sometimes it is a good idea to insert text/bullet points bit by bit.
- But do not exaggerate that.
- It might confuse you.

Advice for Your Slides III - Figures, Animations, etc.

- Figures are great tools for your talk. Use them when ever possible.
  - Scenario, architecture, functional components, ...
- Animations help explaining complicated processes.
  - Protocols!!
  - When using PowerPoint: don’t use fancy effects, fade-in/out is enough.

- Sometimes it is a good idea to insert text/bullet points bit by bit.
- But do not exaggerate that.
- It might confuse you.
- It might as well confuse the audience.

Advice for Your Slides IV - Structure

- As a listening person, it is sometimes difficult to understand in which section the speaker is.
- $\rightarrow$ The audience might confuse background or related work with own work.
- To provide more structure, you can repeat the Agenda slide between sections!

Advice for Slides and Talk

Final Advice...

- Preparation is crucial. $\rightarrow$ Do trial runs in front of friends.
- Use “proper” German (or English). $\rightarrow$ Not everybody understands Bavarian/Saxon/Swabinan dialect!
- Speak loud and clearly.
- Do not speak too fast or too slow.
- Try to emphasize the most important points on your slide verbally.