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Seminar Wissenschaftliches Arbeiten

(Dr. M. Schiffers)

Wintersemester 2018/2019

SPWAL Research Areas (Student Hand-Out)

1 Scope

To pass SPWAL successfully, you have to participate in and contribute to an SPWAL Research Project (SRP). An SRP is defined within the scope of an SPWAL Research Area (SRA). All SRPs aim at conducting specific research studies on a topic induced by the (more general) SRA. Unless otherwise stated, SRPs result in a technical report – (more or less) suitable for a later publication – and a final presentation of the project achievements and methodologies.

As such, SRPs and SRAs provide an excellent preparation for further scientific work during the master's program.

It should be noticed that – as part of the proof of concept – SRPs might occasionally involve the implementation of small code components.

We also want to turn your attention to the summary presentation „SPWAL Research Projects" which can either be opened by clicking on figure 1 or downloaded from the seminar's document repository.

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2 SRA Descriptions

For the fall term 2018/2019 we have identified a pool of seven SRAs. Each SRA is described in more detail in the following subsections by highlighting the background, by giving a short overview of the expected outcome, by listing three typical example[1] SRPs, and by mentioning potential peculiarities related to the SRA. Please be aware that the example projects do *not* constitute a mandatory list of projects. Rather, they are intended as an instigator to propose other SRPs – however, within the context of the SRA.

Should these SRAs not fit at all, we also offer a complementary „Self-Defined Area (SDA)"[2] which you may select in case you wish to assemble your own SRA/SRP combination. Please note, however, that this option needs the instructor's approval in the first place.

[1] These are examples only. You are free to „invent" other SRPs.

[2] covered in subsection 2.8

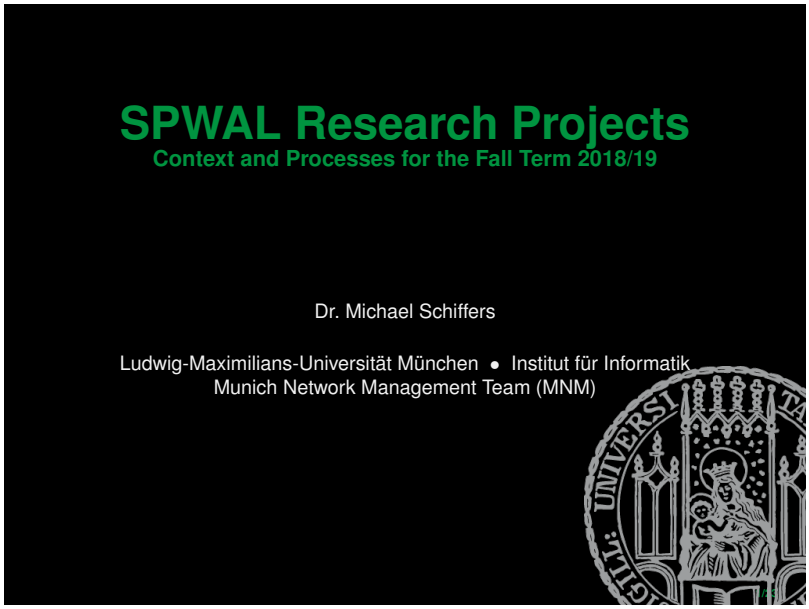


Figure 1: Summary Presentation (open by clicking the slide picture)

We now describe the *predefined* SRAs and the SDA in more detail. Please note that the order of the SRAs neither implies any importance ranking nor any other preferences.

Also note that it is formally allowed that several project teams focus on the *same* SRA – unless they select *different* SRPs within this SRA.

2.1 *CyberDemise*

Background:

Assuming that each and every Web Object of Interest (WOoI)[3] leaves a digital footprint in the web cyber space, the question emerges: What happens to this information in case of a WOoI's demise?[4] This SRA addresses this question.

[3] used here as a catch-all term for web representations of humans and things

[4] real or virtual

Expectations:

An SRP proposal for *CyberDemise* should clearly address a scientific research question to be answered, the methodology to be applied in order to achieve the project's objectives, the expected outcome, the context as far as related work is concerned, and the method to prove the expected outcome[5].

[5] this does not necessarily mean „code".

Examples of related SRPs:

Typical examples of concrete projects for this SRA are:

- P_1: Specification (and if possible: implementation) of a service to identify the complete digital footprint of a given WOoI.
- P_2: Specification (and if possible: implementation) of a service to „extinct" a given digital footprint.

P_3: Specification (and if possible: implementation) of a role model for managing „digital heritage“ with all related obligations and benefits.

Remarks:

Time constraints might induce a more focused project proposal. It is up to the project team to define the criteria for narrowing their perspectives. The final decision, however, is taken by the instructor.

References:

The following references might help in setting the context for this SRA.

1. https://digital-danach.de/digital-demise-was-passiert-mit-ihrem-online-leben-wenn-sie-sterben-infografik/
2. [Carroll and Romano, 2011] (copy)
3. [Kranzlmüller, 2015] (copy)
4. [Koops, 2011] (copy)
5. [Grimm and Chiasson, 2014] (copy)

2.2 *Robotics*

Background:

By 2020, more than 1.7 million new industrial robots will be installed in factories around the world – according to the latest forecast from the International Federation of Robotics (IFR)[6]. The report sees the European Union as one of the global frontrunners as 65 percent of countries with an above-average number of industrial robots per 10,000 employees, are located in the EU.

IPR also reports on the considerable rise of the total number of professional service robots by 2020.

In this SRA we want to address (some of) the issues related to this growth from a computer science perspective.

[6] http://www.ifr.org

Expectations:

An SRP proposal for *Robotics* should clearly address a scientific research question to be answered, the methodology to be applied in order to achieve the project's objectives, the expected outcome, the context as far as related work is concerned, and the method to prove the expected outcome[7].

[7] this does not necessarily mean „code“.

Examples of related SRPs:

Typical examples of concrete projects for this SRA are:

P_1: Elaboration of a scenario taking advantage of cooperative autonomous underwater drones („swarm robotics“).

P_2: Specification (and if possible: implementation) of a service to apply deep learning artificial intelligence techniques to detect scientific paper plagiarism.

P_3: Methodology of detecting violations of Asimov's Laws of Robotics. [Barthelmess and Furbach, 2014]

Remarks:

Time constraints might induce a more focused project proposal. It is up to the project team to define the criteria for narrowing the perspectives. The final decision, however, is taken by the instructor.

References:

The following references might help in setting the context of this SRA.

1. [Barthelmess and Furbach, 2014] (copy)
2. [Ducatelle et al., 2014] (copy)
3. [Vergouw et al., 2016] (copy)
4. [Kehoe et al., 2015] (copy)
5. [Yan et al., 2013] (copy)

2.3 *GreenComputing*

Background:

Green computing[8] denotes the study and practices of environmentally sustainable computing or IT. The objectives of green computing are to reduce the use of hazardous materials, to maximize energy efficiency during the product's lifetime, and to promote the recyclability or biodegradability of defunct products and factory waste. Given this context, we observe that large data centers may have enormous energy footprints[9] and that e-waste is dramatically increasing [Balde, 2015]. The question thus arises: Are there alternatives?

In this SRA we want to approach (some of) the issues related to *GreenComputing* from a computer science perspective.

[8] also referred to as „Green IT"

[9] see e.g. the Green500 list

Expectations:

An SRP proposal for *GreenComputing* should clearly address a scientific research question to be answered, the methodology to be applied in order to achieve the project's objectives, the expected outcome, the context as far as related work is concerned, and the method to prove the expected outcome[10].

[10] this does not necessarily mean „code".

Examples of related SRPs:

Typical examples of concrete projects for this SRA are:

P_1: Provide an in-depth analysis of the energy efficiency crypto techniques (traditional techniques, blockchain techniques).

P_2: Provide an elaborated scenario of the application of „swarms of“ Nano Data Centers and demonstrate its advantages/disadvantages compared to traditional „monolithic“ data centers

P_3: Specification, simulation, and partly implementation of an e-waste exchange trading service (analogy to the EU Emissions Trading System (EU ETS)[11]).

[11] https://ec.europa.eu/clima/policies/ets_en

Remarks:

Time constraints might induce a more focused project proposal. It is up to the project team to define the criteria for narrowing the perspectives. The final decision, however, is taken by the instructor.

References:

The following references might help in setting the context for this SRA.

1. https://www.top500.org/green500/
2. [Valancius et al., 2009] (copy)
3. [Jalali et al., 2014] (copy)
4. [O'Dwyer and Malone, 2014] (copy)
5. [Bakker et al., 2012] (copy)
6. [Balde, 2015] (copy)

2.4 *E-Voting*

Background:

As outlined in [Trechsel et al., 2016], the implementation of e-voting *„carries the promise of elections with more participants, of strengthened efficiency in the electoral process, and the hope of bringing voters and their representatives closer together.“*

However, e-voting needs to be balanced between many potential advantages such as facilitating the voting process, increased convenience to voters, gains in efficiency, and multiple challenges which, if not properly addressed, can undermine the integrity of elections.

Technological and security concerns are often pointed at as the main threats to e-voting. Nonetheless, research demonstrates that the multiplication of pilots, trials and number of e-enabled elections has been contributing decisively for the development of more secure e-voting systems as pointed out in [Farivar, 2016]. In addition, recommendations for a coordinated but decentralised e-voting system might offer adequate solutions in terms of damage control in the event of attack or partial system malfunction.

In this SRA we want to approach (some of) the issues related to *E-Voting*.

Expectations:

An SRP proposal for *E-Voting* should clearly address a scientific research question to be answered, the methodology to be applied in order to achieve the project's objectives, the expected outcome, the context as far as related work is concerned, and the method to prove the expected outcome[12].

[12] this does not necessarily mean „code".

Examples of related SRPs:

Typical examples of concrete projects for this SRA are:

- P_1: Attack an e-voting system (examples are reported in [Küsters et al., 2012] and [Cortier and Smyth, 2011]) and propose countermeasures.
- P_2: Experiment with and evaluate the „Helios Voting system"[13]. For evaluation purposes, a simulation of a non-trivial medium-scale election is required. Please be aware that criteria are required to assess the pros and cons of the Helios system.
- P_3: Specification (and if possible: implementation) of a „Tor"-based[14] approach to e-voting. Identify the opportunities and shortcomings.

[13] https://heliosvoting.org/ and [Smyth et al., 2017]

[14] https://www.torproject.org/

Remarks:

Time constraints might induce a more focused project proposal. It is up to the project team to define the criteria for narrowing the perspectives. The final decision, however, is taken by the instructor.

References:

The following references might help in setting the context of this SRP.

1. [Trechsel et al., 2016] (copy)
2. [Farivar, 2016]
3. [Küsters et al., 2012] (copy)
4. [Cortier and Smyth, 2011] (copy)
5. [Jones, 2010] (copy)
6. [Smyth et al., 2017] (copy)

2.5 *CryptoCurrency*

Background:

In their Global Risks Report 2017 the World Economic Forum have emphasized the importance of observing emerging developments *„in cryptographic systems that manage and verify distributed*

transaction data on a public ledger, increasing transparency and securing an immutable record for application to cryptocurrencies such as bitcoin as well as for verification of varieties of transactions across industries, especially in financial technologies (FinTech).“ [World Economic Forum, 2017]. While we see the share of cash-based transactions in the economy declining [Davies et al., 2017], we realize at the same time the rise of cryptocurrencies, with Bitcoin as the heavyweight [Tasca, 2016]. Several open research questions motivate Lindman et al. to propose a dedicated research agenda [Lindman et al., 2017].

In this SRA we want to approach (some of) the issues related to *CryptoCurrency*.

Expectations:

An SRP proposal for *CryptoCurrency* should clearly address a scientific research question to be answered, the methodology to be applied in order to achieve the project's objectives, the expected outcome, the context as far as related work is concerned, and the method to prove the expected outcome[15].

[15] this does not necessarily mean „code“.

Examples of related SRPs:

Typical examples of concrete projects for this SRA are:

- P_1: Specification (and if possible: implementation) of a gossip-based blockchain based on the van Renesse-proposals [Renesse, 2016].
- P_2: Kickstart an Ethereum[16] project with a trustless crowdsale on a self-selected topic, report the lessons learned, and review advantages and disadvantages. Please be aware that it requires criteria to determine an assessment of pros and cons. In lieu of Ethereum other platforms may be used as well.
- P_3: Visualization and interpretation of large Bitcoin data sets.[17] A first hint is given by Benedikt Koehler in http://beautifuldata.net/2015/01/querying-the-bitcoin-blockchain-with-r/.

[16] https://ethereum.org/

[17] preferably in „R“

Remarks:

Time constraints might induce a more focused project proposal. It is up to the project team to define the criteria for narrowing the perspectives. The final decision, however, is taken by the instructor.

References:

The following references might help in setting the context for this SRP.

1. https://www.zurich.ibm.com/dccl/#program
2. [Davies et al., 2017] (copy)
3. [Lindman et al., 2017] (copy)
4. [Tasca, 2016] (copy)

5. [Renesse, 2016] (copy)
6. [Zheng et al., 2017] (copy)

2.6 *Disaster*

Background:

The UN Office for Disaster Risk Reduction (UNISDR) not only reports that close to one billion people were affected by natural disasters in 2015. The office also points out the environmental risks and infrastructure damage caused by geophysical disasters such as earthquakes, volcanic activity, landslides, tsunamis, or geomagnetic storms.

Additionally, we observe emergency situations, natural disasters and disaster events[18] happening with increasing frequency and ferocity around the Globe (see [Guha-Sapir et al., 2016]). However, with the rapid advance of new technologies there is an opportunity to build more intelligent systems taking real-time data into account thereby enabling enhanced emergency and disasters monitoring and management systems. While most projects in the past focused on modelling flooding, radiation transport, forest fires, or air pollution, an overall framework for emergency situations and disaster modelling and simulation and their monitoring and management is not on the horizon.

This SRA contributes to bridging some of these gaps.

[18] The Centre for Research on the Epidemiology of Disasters (University of Leuven, Belgium) defines a disaster as *„[a] situation or event, which overwhelms local capacity, necessitating a request to national or international level for external assistance [. . .]; an unforeseen and often sudden event that causes great damage, destruction and human suffering. Though often caused by nature, disasters can have human origins.“*. (https://www.emdat.be/Glossary)

Expectations:

An SRP proposal for *Disaster* should clearly address a scientific research question to be answered, the methodology to be applied in order to achieve the project's objectives, the expected outcome, the context as far as related work is concerned, and the method to prove the expected outcome[19].

[19] this does not necessarily mean „code“.

Examples of related SRPs:

Typical examples of concrete projects for this SRA are:

- P_1: Specification (and if possible: implementation) of a decision support system for emergency and disaster management triggered by naturally caused events[20].
- P_2: Specification (and if possible: implementation) of a disaster management architecture based on the Dynamic Data Driven Application Systems (DDDAS) paradigm[21] as considered in [Darema, 2005].
- P_3: Specification (and if possible: implementation) of an emergency reaction system based on the „Urgent Computing“ paradigm as considered in [Leong, 2016].

[20] like floods, tsunamis, earthquakes, hurricanes, volcano eruptions

[21] also known as „Cyber-Applications-Systems“ [Darema, 2010]

Remarks:

Time constraints might induce a more focused project proposal. It is up to the project team to define the criteria for narrowing the perspectives. The final decision, however, is taken by the instructor.

References:

The following references might help in setting the context for this SRA.

1. http://www.dddas.org/
2. [Darema, 2005] (copy)
3. [Darema, 2010] (copy)
4. [Leong and Kranzlmüller, 2015] (copy)
5. [Leong, 2016] (copy)
6. [World Economic Forum, 2017] (copy)
7. [Guha-Sapir et al., 2016] (copy)

2.7 *HateFake*

Background:

Fake news[22], as a first approximation defined as news stories that have no factual basis but are presented as facts, are not new. However, with the rise of social media and increasingly savvy revenue generating fake news sites, fakes induce several open research issues as far as their importance, their detection, and the adequacy of answers to them are concerned. This development correlates well with the sociological phenomenon of hate and lie in general.[23]

In this SRA we want to approach (some of) these issues from a computer science perspective.

[22] also referred to as „hoax“

[23] see e.g `http://www.bbc.com/news/magazine-36964916`

Expectations:

An SRP proposal for *HateFake* should clearly address a scientific research question to be answered, the methodology to be applied in order to achieve the project's objectives, the expected outcome, the context as far as related work is concerned, and the method to prove the expected outcome[24].

[24] this does not necessarily mean „code“.

Examples of related SRPs:

Typical examples of concrete projects for this SRA are:

- P_1: Specification (and if possible: implementation) of a methodology to distinguish between fakes and facts.
- P_2: Redo the experiments reported in [Wineburg et al., 2016] with a focus, however, on Germany (maybe Europe), evaluate the results, and compare the findings with [Wineburg et al., 2016].

P_3: Specification (and if possible: implementation) of a methodology to detect offensive statements towards well defined groups (similar to [Bretschneider and Peters, 2017]).

Remarks:

Time constraints might induce a more focused project proposal. It is up to the project team to define the criteria for narrowing the perspectives. The final decision, however, is taken by the instructor.

References:

The following references might help in setting the context for this SRA.

1. http://www.fakenewschallenge.org/
2. https://www.wired.com/2016/12/bittersweet-sweepstakes-build-ai-destroys-fake-news/
3. http://www.spektrum.de/news/fake-news-koennen-algorithmen-falschmeldungen-entlarven/1435459
4. https://www.nytimes.com/2017/01/19/learning/lesson-plans/evaluating-sources-in-a-post-truth-world-ideas-for-teaching-and-learning-about-fake-news.html?_r=0
5. [Conroy et al., 2015] (copy)
6. [Allcott and Gentzkow, 2017] (copy)
7. [Wineburg et al., 2016] (copy)
8. [Bretschneider and Peters, 2017] (copy)

2.8 *Self-Defined Area*

Background:

SDA is an option to consider should the SRAs described in subsections 2.1 to 2.7 not fit at all. In this case, you are invited to define your own SRA/SRP combination.

Expectations:

An SRP proposal for the *Self-Defined Area* should clearly address a scientific research question to be answered, the methodology to be applied in order to achieve the project's objectives, the expected outcome, the context as far as related work is concerned, and the method to prove the expected outcome[25].

[25] this does not necessarily mean „code".

Your SRA and the associated SRP must be defined in the proposal and they need the approval of the instructor. For a self-defined SRA you need to present a reproducible – or at least provable – observation[26] and a comprehensible hypothesis explaining the observation. Derive clearly the implications and research questions your observation might have and/or instigate.

[26] no weird guesses, please

Examples of SRAs:

The following are examples of additional SRAs. For more information on these topics please conduct your own research to identify specific research questions you want to cover in your SRP. You are also free to extend the SRA-list any further.

A_1: Smart Homes

A_2: Smart Cities

A_3: Quantum Computing

A_4: Car-to-Car Communication

A_5: Affective Computing

A_6: Survival in Outer Space from a Computer Science perspective

A_7: Bio-inspired computing

A_8: Exa/Ultra Scale Computing

A_9: Smart dust

A_{10}: Just-in-time public transportation services (example: How to achieve better punctuality for the Deutsche Bahn)

3 *SRP Process*

The purpose of an SRP is to do research in a supervised and controlled hands-on training environment. It is *not intended* to execute the projects as a „one person show". Consequently, teamworking is not only strongly recommended, it is definitely required. Therefore, *successfully* implementing an SRP is based on the following steps (see also figure 2).

Step I: Select your SRA, join an SRA-team, give the team a name, help organizing the team, and jointly determine the SRP.

Step II: Perform a thorough literature review to determine your SRP's context.[27]

The purpose of the literature review is to learn more about the selected topic, narrow the scope of the project, and provide inspirations for possible solutions or ideas that you may want to investigate in the SRP you are proposing.

[27] This is a team effort!

Step III: Provide a research proposal.[28]

Submit your team's research proposal within the first three weeks of the semester (see the „Milestones" section on page 12). The proposal will be reviewed to ensure

[28] This is a team effort!

appropriate scope, rigor, and methodological soundness. The proposal structure is given in the section „Reports“ on page 18.

Step IV: Manage project progress and expectations.[29]

The project team is expected to meet with the instructor on a regular basis[30]. Sustained progress is expected throughout the duration of the project while the team is carrying out research activities as defined in the proposal. At the end of each month (except the last month), the team must submit a formal progress report as given in the section „Reports“ on page 18.

[29] This is a team effort!

[30] to be defined individually, but see the „Milestones“ section on page 12

Step V: Provide the final deliverables.[31]

Each of the final project deliverables must be listed on the schedule defined in the proposal. The deliverables must include at least:

- A *technical report* the structure of which is given in the section „Reports“ on page 18.
- The *final presentation* which summarizes the project and its achievements. The presentation needs to be given at the seminar's presentation day[32] (see appendix „Milestones“ on page 12 for the exact date of the presentation day).
- *Other* research deliverables if relevant: source code, data, etc.

[31] This is a team effort!

[32] duration: 30 minutes

4 Milestones

For the SRPs you have to observe the deadlines and milestones as given in appendix „Milestones“ on page 16.

5 Grading

The grading algorithm is reflected in table 1 in appendix „Grading“ on page 15 by indicating the weights. Be aware that the grading contains a team grading component which will be applied to *all* team members. In other words: Hiding yourself in your project team without making any contributions to the team's success will definitely be disadvantageous.

In order to pass SPWAL successfully, you need to achieve at least 70% of all points.

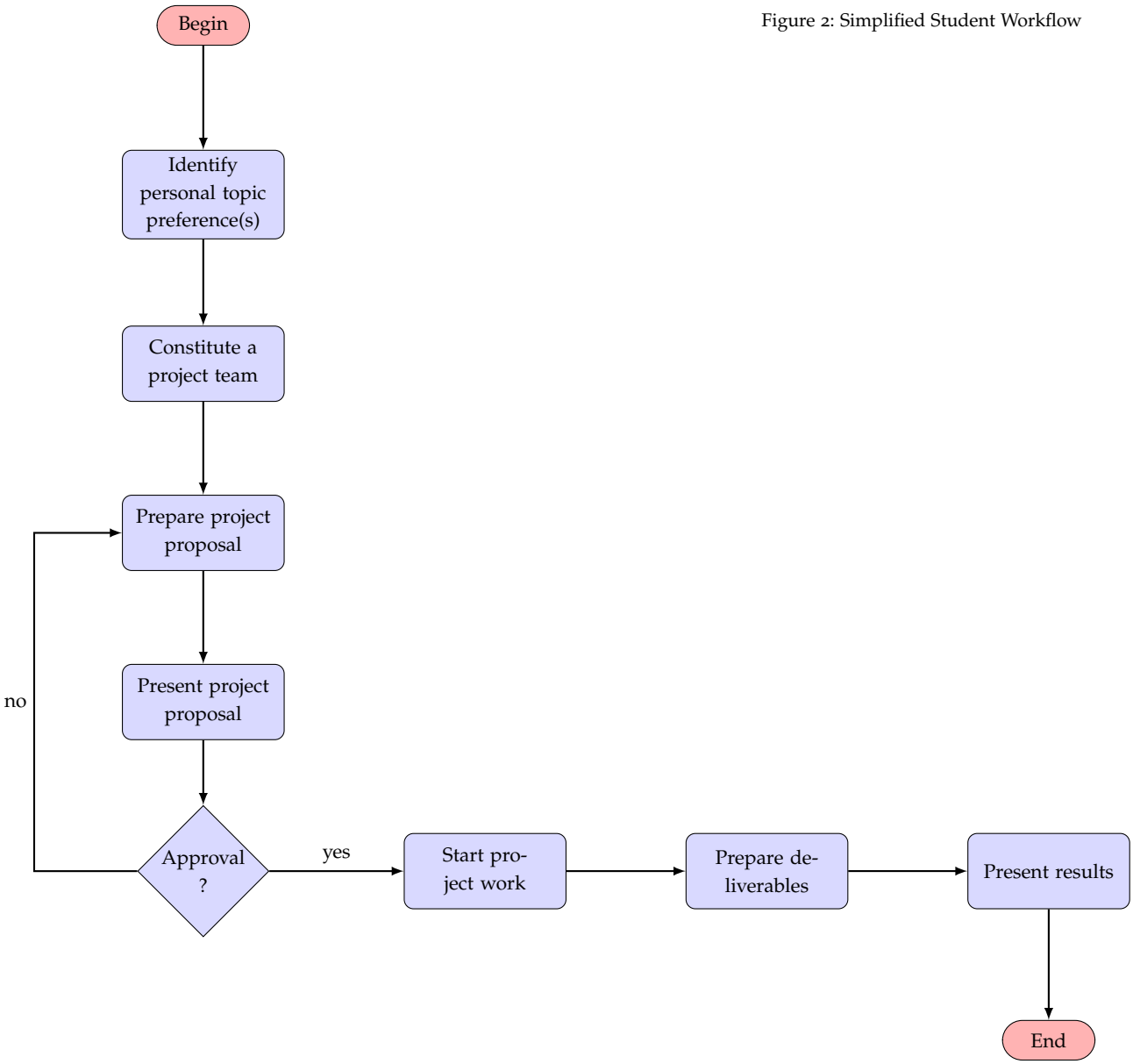


Figure 2: Simplified Student Workflow

Appendices

Grading

Table 1: Grading

Component	***Sample Criteria***	***Percentage (%)***
Project proposal	Is it structured as specified in the guidelines? Is it well written? Does it clearly state the problem(s) to address and/or the application(s) to design? Are project goals and schedules feasible? Does the proposal review related work thoroughly enough? Is the method for proving the outcome well defined? What distinguishes the proposed work from similar work?	20
Progress reports (2 reports)	Does the project progress meet expectations? Are the reports structured as specified in the guidelines? Are the progress reports reflecting the progress exactly? Are the deviations from plan explained? Are the next steps comprehensible?	10
Research work	What makes your research work different from existing work? What contributions does your project make? Did it meet its intended goals? Why and how did you narrow your focus? How significant are the outcomes? How disputable are the achievements?	20
Technical report	Is it structured as specified in the guidelines? Is the methodology clearly described? Are the citations correct? Is it structured as specified in the guidelines? Is it well written?	20
Final presentation	Did you clearly convey what you did? Did you stay within time limits? Could you answer the questions?	15
Teamwork	How did the team cooperate? How was the work spread across the team?	10
Professionalism	Did you commit your time and meet the deadlines?	5
	Total	100

Milestones

For the Fall Term 2018 the deadlines and milestones to be observed are as follows. Note that milestones on Tuesdays require deliverables to be uploaded on Mondays!

Table 2: Deadlines and milestones

Calendar	*Deadlines / Milestones (see Gantt)*	*Deliverables*
October 2018 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	G_1 *(23.10.)* First session (briefing) S_1 *(30.10.)* Start SRP	
November 2018 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	M_1 *(13.11.)* Research proposal ready M_2 *(27.11.)* Progress report I ready	X X
December 2018 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	S_2 *(18.12.)* Mid term synchronisation	
January 2019 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	M_3 *(15.1.)* Progress Report II ready M_4 *(22.1.)* Final deliverables ready M_5 *(29.1.)* Presentation Day (1) S_3 *(29.1.)* End SRP	X X
February 2019 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	G_2 *(5.2.)* Last session (debriefing, presentation day (2))	

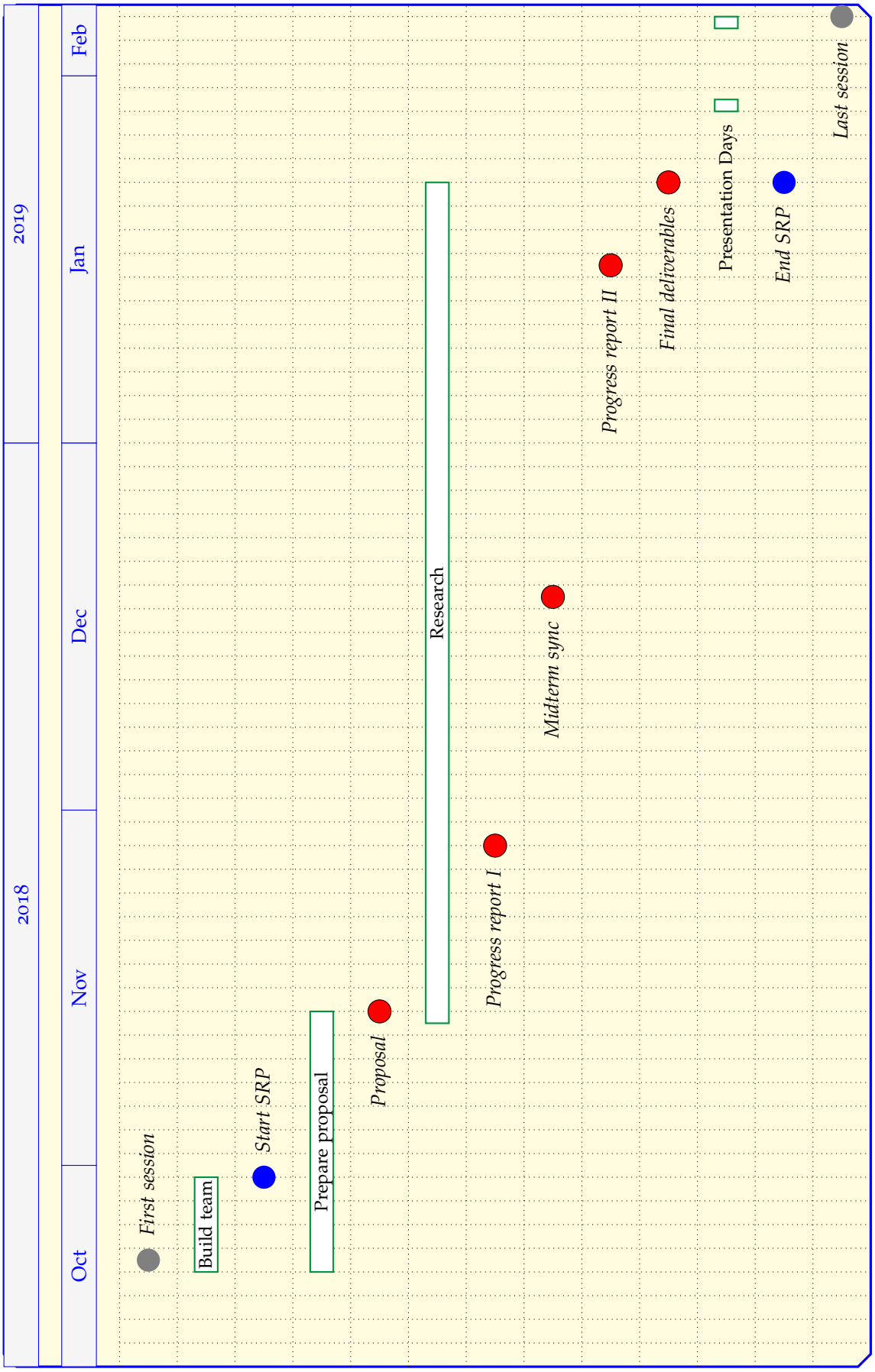


Figure 3: Gantt Chart

Reports

Overview

While figure 4 summarizes the mandatory reports to be delivered during the summer term, table 3 summarizes the commonalities of and the differences between the various SRP reports.

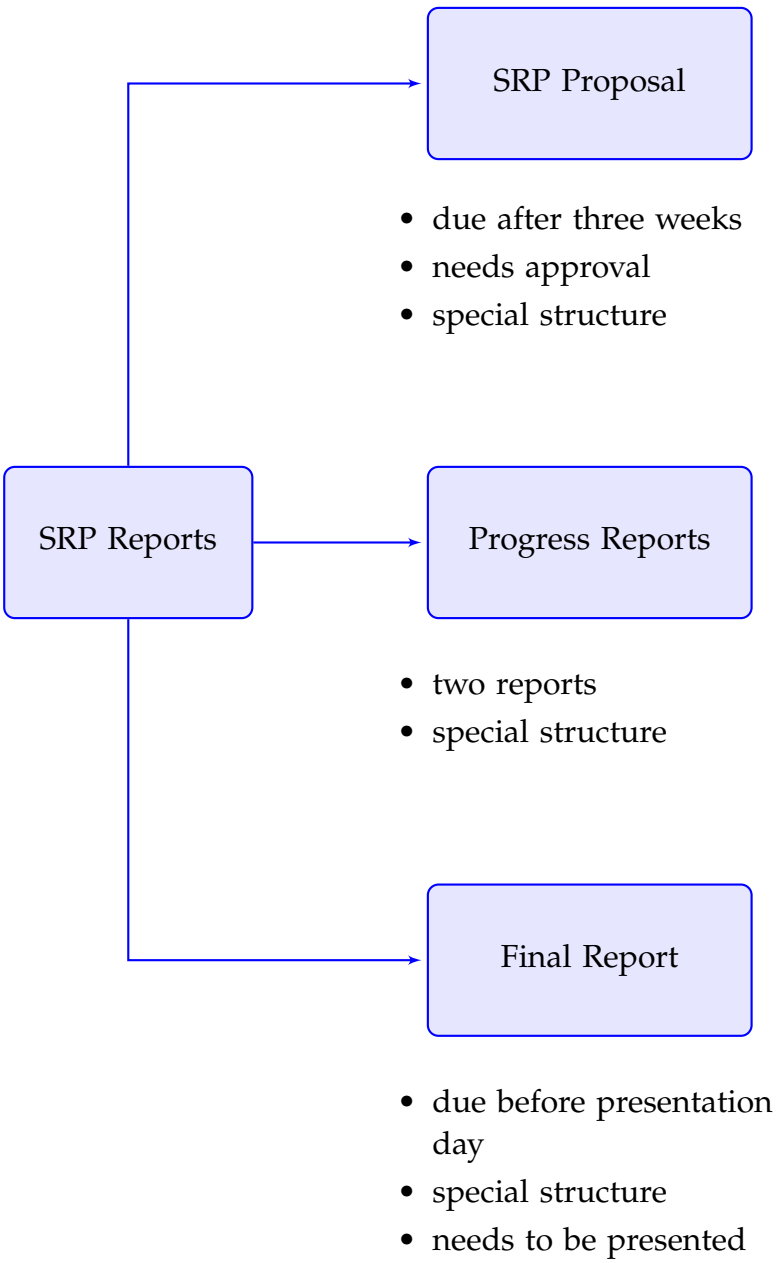


Figure 4: Mandatory Reports

Table 3: Report structures

	SRP Proposal	*Progress Reports*	*Final Report*
Cover sheet			
· project acronym	X	X	X
· project title	X	X	X
· list of all authors	X	X	X
· corresponding author	X	X	X
Abstract	X		X
References	X		X
Problem statement	X		
Related work	X		X
Justification	X		
Methodology to achieve objectives			X
Evaluation	X		X
Risk analysis	X		
Achievements		X	X
Next steps		X	
Deviation from plan		X	
Introduction	X		X
Description of research[33]			X
Conclusion			X
Future work			X
Predefined format[34]	X	X	X
Requires approval	X		
May lead to SRP adjustments		X	
Requires formal presentation			X
Number of pages	~5	~3	= 8
Paper format	A4	A4	A4
Number of reports	1	2	1
Due at[35]	M_1	M_2, M_3	M_4

[33] includes outline of applied methodology

[34] see „Milestones“ on page 16

[35] see „Report Formatting“ on page 22

SRP Proposal

It is *mandatory* that the SRP proposal includes these sections:

- **Cover Sheet**. The cover sheet contains an acronym, a title, the list of *all* contributing authors, the name of the corresponding author, and – if available – a URL pointing to the project's web site.
- **Problem Statement**. What problem is the project addressing? Why is the problem interesting?
- **Related Work**. Paraphrase what you have discovered in your literature review.
- **Justification**. Briefly justify the project idea. What is new? How is your idea different or better than others'? Or how does this study/investigation contribute to the existing body of knowledge?
- **Evaluation**. How are you going to test/evaluate your idea? Describe any software you may need to build. List resources you may need to carry out the project.
- **Research Plan**. List all roles, tasks, and milestones, and prepare an activities schedule for completing the project in right time – given the deadline constraints (see the „Milestones“ section on page 12). This section also contains a short description of the methodology to be applied in order to achieve the project's objectives.
- **References**. A comprehensive list of references properly cited in the document.

Progress Reports

It is *mandatory* that each progress report[36] includes:

[36] Currently two progress reports are scheduled (see table 2 on page 16).

- **Cover Sheet**. The cover sheet contains the acronym, the title, the list of *all* contributing authors, the name of the corresponding author, and – if available – a URL pointing to the project's web site.
- **Achievements**. Describe the project's achievement during the reporting period.
- **Next Steps**. Outline the intended steps to be performed during the next reporting period.
- **Deviation from Plan**. Should there be any discrepancies between the plan and the reality, describe and justify them. Please indicate any means to adjust the project to the plan, if necessary.

Final Report

It is *mandatory* that the final SRP report includes:

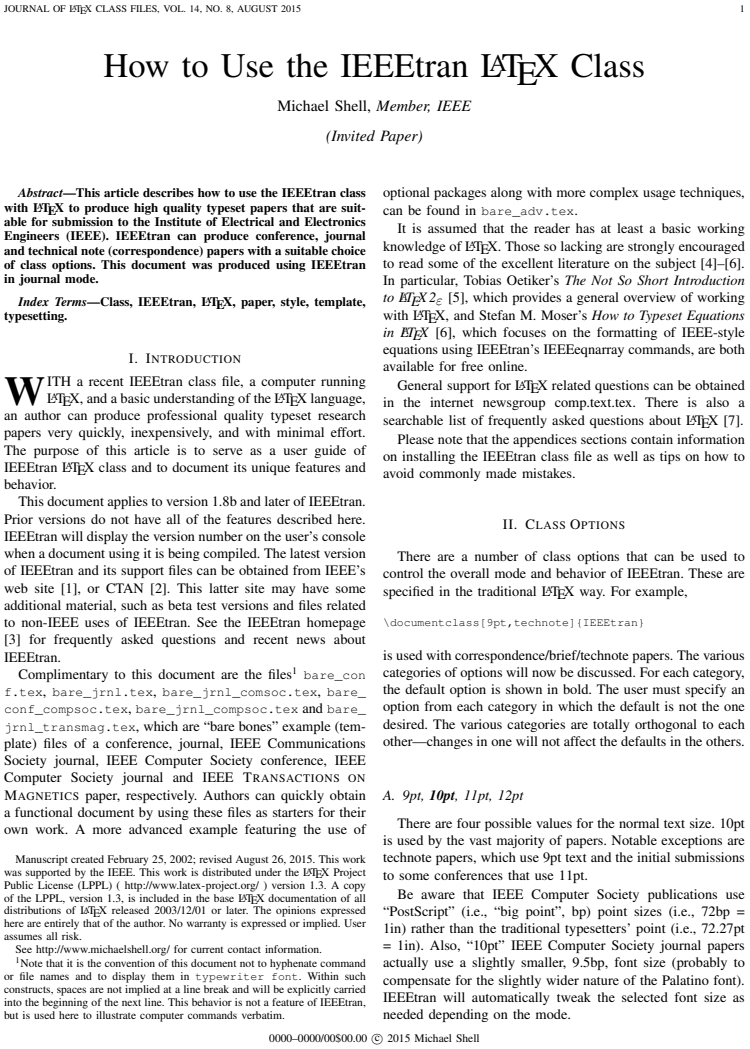
- **Cover Sheet**. The cover sheet contains the acronym, the title, the list of *all* contributing authors, the name of the corresponding author, and – if available – a URL pointing to the project's web site.
- **Abstract**. Briefly describe your project's goals, methodologies, and contributions.
- **Introduction**. Describe the context of your project, the project goals and the contributions.
- **Related Work**. Discuss existing work relevant to your project and what distinguishes your achievements from existing work.
- **Description of Research**. Describe models and assumptions (if any). Detail project goals and design of your project and explain how the design fulfills the goals?
- **Evaluation / Results**. Describe your evaluation methodology and present results and analyses.
- **Conclusion**. What lessons are learned and what goals are achieved in the project.
- **Future Work**. How would you extend your work in subsequent steps? What issues are remaining open?
- **References**. Provide a comprehensive list of references properly cited in the document.

Report Formatting

For formatting the various reports, it is mandatory that you apply the IEEE Transactions templates which you may modify slightly (e.g., remove or replace logos or empty headlines).

You need to download the templates from https://ieeeauthorcenter.ieee.org/create-your-ieee-article/use-authoring-tools-and-ieee-article-templates/ieee-article-templates/templates-for-transactions/. The templates are available for Word and LaTeX. Although we strongly recommend LaTeX, we also allow Word (or derivatives like Apache OpenOffice).

Please read the instructions attached to the templates carefully. The basic layout of the template is given in figure 5.



JOURNAL OF LATEX CLASS FILES, VOL. 14, NO. 8, AUGUST 2015 1

How to Use the IEEEtran LaTeX Class

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(Invited Paper)

***Abstract*—This article describes how to use the IEEEtran class with LaTeX to produce high quality typeset papers that are suitable for submission to the Institute of Electrical and Electronics Engineers (IEEE). IEEEtran can produce conference, journal and technical note (correspondence) papers with a suitable choice of class options. This document was produced using IEEEtran in journal mode.**

***Index Terms*—Class, IEEEtran, LaTeX, paper, style, template, typesetting.**

I. Introduction

WITH a recent IEEEtran class file, a computer running LaTeX, and a basic understanding of the LaTeX language, an author can produce professional quality typeset research papers very quickly, inexpensively, and with minimal effort. The purpose of this article is to serve as a user guide of IEEEtran LaTeX class and to document its unique features and behavior.

This document applies to version 1.8b and later of IEEEtran. Prior versions do not have all of the features described here. IEEEtran will display the version number on the user's console when a document using it is being compiled. The latest version of IEEEtran and its support files can be obtained from IEEE's web site [1], or CTAN [2]. This latter site may have some additional material, such as beta test versions and files related to non-IEEE uses of IEEEtran. See the IEEEtran homepage [3] for frequently asked questions and recent news about IEEEtran.

Complimentary to this document are the files[1] bare_conf.tex, bare_jrnl.tex, bare_jrnl_comsoc.tex, bare_conf_compsoc.tex, bare_jrnl_compsoc.tex and bare_jrnl_transmag.tex, which are "bare bones" example (template) files of a conference, journal, IEEE Communications Society journal, IEEE Computer Society conference, IEEE Computer Society journal and IEEE Transactions on Magnetics paper, respectively. Authors can quickly obtain a functional document by using these files as starters for their own work. A more advanced example featuring the use of optional packages along with more complex usage techniques, can be found in bare_adv.tex.

It is assumed that the reader has at least a basic working knowledge of LaTeX. Those so lacking are strongly encouraged to read some of the excellent literature on the subject [4]–[6]. In particular, Tobias Oetiker's *The Not So Short Introduction to LaTeX 2ε* [5], which provides a general overview of working with LaTeX, and Stefan M. Moser's *How to Typeset Equations in LaTeX* [6], which focuses on the formatting of IEEE-style equations using IEEEtran's IEEEeqnarray commands, are both available for free online.

General support for LaTeX related questions can be obtained in the internet newsgroup comp.text.tex. There is also a searchable list of frequently asked questions about LaTeX [7].

Please note that the appendices sections contain information on installing the IEEEtran class file as well as tips on how to avoid commonly made mistakes.

II. Class Options

There are a number of class options that can be used to control the overall mode and behavior of IEEEtran. These are specified in the traditional LaTeX way. For example,

```
\documentclass[9pt,technote]{IEEEtran}
```

is used with correspondence/brief/technote papers. The various categories of options will now be discussed. For each category, the default option is shown in bold. The user must specify an option from each category in which the default is not the one desired. The various categories are totally orthogonal to each other—changes in one will not affect the defaults in the others.

*A. 9pt, **10pt**, 11pt, 12pt*

There are four possible values for the normal text size. 10pt is used by the vast majority of papers. Notable exceptions are technote papers, which use 9pt text and the initial submissions to some conferences that use 11pt.

Be aware that IEEE Computer Society publications use "PostScript" (i.e., "big point", bp) point sizes (i.e., 72bp = 1in) rather than the traditional typesetters' point (i.e., 72.27pt = 1in). Also, "10pt" IEEE Computer Society journal papers actually use a slightly smaller, 9.5bp, font size (probably to compensate for the slightly wider nature of the Palatino font). IEEEtran will automatically tweak the selected font size as needed depending on the mode.

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See http://www.michaelshell.org/ for current contact information.

[1]Note that it is the convention of this document not to hyphenate command or file names and to display them in typewriter font. Within such constructs, spaces are not implied at a line break and will be explicitly carried into the beginning of the next line. This behavior is not a feature of IEEEtran, but is used here to illustrate computer commands verbatim.

Figure 5: Basic layout of the IEEE Transactions Template

Abbreviations

Abbreviation	*Meaning*	*Defined on Page*
DDDAS	Dynamic Data Driven Application Systems	8
EU ETS	EU Emissions Trading System	5
SDA	Self-Defined Area	1
SRA	SPWAL Research Area	1
SRP	SPWAL Research Project	1
UNISDR	UN Office for Disaster Risk Reduction	8
WOoI	Web Object of Interest	2

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