

THE BEST METHOD FOR PRESENTATION OF RESEARCH RESULTS

Veljko Milutinovic
emilutiv@etf.bg.ac.yu
(381-11) 762-214

Department of Computer Engineering
School of Electrical Engineering
University of Belgrade
POB 816
11000 Belgrade
Yugoslavia

Abstract

The major goal of this paper is to serve as a guideline for organization of research presentations in oral or written form. Another important goal of this paper is to convince the researchers to use the author's semantics-based layout strategy for transparencies. The major purpose of the entire effort is to make the research presentations as easy to comprehend as absolutely possible. Proper usage of the guidelines and strategies defined in this paper is a *conditio sine qua non* for those graduate students who have chosen that the author of this paper be their major professor. The same structure is being used for thesis work, as well as for conference and journal publications, or technical reports to research sponsors, both by graduate students and professional engineers.

1. Introduction

This paper focuses on a method for presentation of research results (in written and/or oral form) and focuses on the following issues:

- (a) Selection of the title;
- (b) Structure of the abstract;
- (c) Structure of the figures and/or tables and their captions;

- (d) Syntax of references;
- (e) Structure of the written paper and the corresponding oral presentation using transparencies;
- (f) Semantics-based layout of transparencies for an oral presentation.

Intentionally, the entire text to follow has been made relatively short, so more people decide to read it. This paper represents the decades-long research experience of the author, and summarizes the mandatory requirements that he places before his graduate students.

The motivation to publish this paper (which is in use at the University of Belgrade for about half decade now) came after the repeated pattern at international conferences where lots of good research was presented in such a way that research results are obscured by poor presentation. It was not possible to understand quickly, either the essence of the contribution, or the most important research details.

At a recent major set of computer science/engineering conferences, no single presentation was following either the guidelines presented below, or the semantics-based layout of transparencies to be defined below.

2. Selection of the Title

The selection of title should be both didactic and lapidary.

In this context, didactic means creating a title which enables an expert to figure out the essence of the basic idea and the main contribution, even without reading the paper; lapidary means creating a title which induces the reader to think deeply over the "philosophy" of the contribution described in the paper.

A relatively good example of a didactic and lapidary title is:

APPLYING ENTRY AND LAZY RELEASE
SELECTIVELY:
TEMPORAL VERSUS SPATIAL DATA

This title is didactic since it is immediately obvious that the main idea is to apply the entry consistency model to temporal data and the lazy release consistency model to spatial data, for the performance which is better than applying only one of the two models to all data.

This title is also lapidary, since one immediately starts thinking about how the selective application of two different consistency models was really implemented.

An alternative (bad) title would be:

SOME ISSUES
IN MEMORY CONSISTENCY MODELING

People would tend to stay away from a paper with such a title, since that kind of title might be viewed as an introduction into a contents-free paper, unless it comes from a well known expert who has a reputation of knowing what he/she is doing. Consequently, a good idea may not be noticed by the research community, and those who reinvent it at a later time will get the credit instead of the initial inventor.

2.1. Structure of the Abstract

Wherever possible, the abstract of a research paper should include the following five elements:

- (a) Problem statement of the research under consideration;
- (b) A short list of existing solutions and what is their drawback, from the point of view of the above defined problem statement;
- (c) Essence of the proposed solution, and why it is expected to be better under the same conditions;
- (d) What type of analysis was done to show that the proposed solution is really better than any of the existing ones, from both the performance and

the complexity points of view (if one is an engineer, then both performance and complexity are equally important);

- (e) What are the major numerical highlights of the analysis (if one is an engineer, numbers are the "name of the game").

If a 50-word abstract is required, then each part above should be about one sentence long; if a 500-word abstract is required, then each part above should be about 10 sentences long, etc. Of course, the language should be simple and concise, with declarative sentence structure, written primarily in the present tense.

3. Structure of the Figures and/or Tables and the Related Captions

Figures and tables should include only language-independent mnemonics (derived from English language), which is especially important for non-English-speaking researchers, and for those writing for many languages, so it is easier to switch back and forth between languages.

All details must be clearly visible, even after the same figure is ported to a transparency for an oral presentation.

Captions deserve a special attention, which is neglected in a typical written presentation. The main issue is that reading only the figure captions of the paper can substitute the first rough reading of the entire paper. This goal is achieved more successfully if the caption includes the following five elements:

- (a) Title with the main highlight, i.e. the main issue to be demonstrated by the corresponding figure/table;
- (b) Legend, to explain all language-independent mnemonics inside the figure/table;
- (c) Description, of one or more phenomena which deserve attention (e.g., curves A and B cross each other at $X=16$);
- (d) Explanation, of the essential reason for such a behavior (e.g., the curves cross each other because for higher values of X , the following happens ...);
- (e) Implication, or what is to be kept in mind when designing/engineering a system to exploit the above noticed phenomenon (e.g., increasing the size of register file helps until the number of registers reaches a critical value; after that ...).

A book which insists on this type of reasoning is [Flynn95]; however, the approach has not been formalized, and this type of reasoning can not be found in figure/table captions. Writing a good caption of this type is extremely difficult for the one who writes the paper (and graduate students often show resistance to such an approach), but extremely useful for the one who reads the paper (and readers/reviewers often show appreciation for such an approach).

Also, this type of caption may become relatively long, and one might think that the limited paper space is not used rationally; however, the captions should include only the facts which are "local" to the figure/table, and these facts should never be repeated again in the main body of the paper. The main body of the paper should include only the "global" facts (e.g., comparing the findings from different figures, and similar).

A similar approach can be found in the famous books of Hennessy and Patterson (alphabetical order), except that their captions do not always have all five elements, and if they do include all five elements, these elements are not formally separated, which is a requirement of the methodology presented here.

All figure and figure captions should be completed **before** the actual writing of the paper starts.

4. Syntax of References

This is another item to be completed **before** the writing of the paper starts. As far as the syntax of references, it is most natural that one follows the syntax used by the most prestigious scientific journal in the field (e.g., IEEE Transactions on ...).

If an alternative approach seems to be better, this methodology suggests that one waits until the major journal accepts it.

As far as the method of pointing to a reference, the mnemonical approach with the entire name of the first author and the year is preferred (so the reader knows immediately what research group the paper comes from). Often, the name of the last author conveys that information more clearly, but it is not practical to use it, when pointing to a reference. Of course, if so required, the above method can be easily converted into the numeric form, mandatory in some journals.

An important reason for doing references before the actual writing starts is that one makes sure that no important reference is omitted; a task more difficult to do after the entire paper is completed.

5. Structure of the Written Paper and the Corresponding Oral Presentation

In the case of a research paper, whenever possible, one should first develop the skeleton of the paper/presentation, to include the following first level titles:

- (a) **Introduction**, to include the basic facts needed to tune the reader to the paper and/or presentation;
- (b) **Problem statement**, to define precisely the problem being attacked by the research under consideration, and why is that problem important;
- (c) **Existing solutions and their criticism**, to survey briefly the major existing solutions from the open literature and to underline their deficiencies from the point of view of interest for this research, which is defined in the above mentioned problem statement section;
- (d) **Proposed solution and why it is expected to be better**, to give the essence of the proposed solution (i.e., the essence of the idea which is to be introduced), followed by a logical and/or philosophical discussion about the expected benefits stemming from the idea;
- (e) **Conditions and assumptions of the research to follow**, to summarize the environment of interest. The term *conditions* refers to the specifiers of the real environment, and the term *assumptions* refers to the simplifications which simplify the analysis without any negative impacts on the validity and representativeness of the final results. It is useful for the reader if conditions and assumptions are itemized (e.g., application-, system-software-, architecture-, organization-, design-, and technology-related);
- (f) **Analytical analysis**, to show one or more of the following:
 - (f1) proof of validity of the major idea of the paper/presentation;
 - (f2) calculation of initial values for simulation analysis to follow;
 - (f3) rough estimation of the performance;
 - (f4) rough estimation of the complexity;
 - (f5) something else which is relevant;Analytical analysis will not give the final answers; however, it will help understanding

the concept (it will be helpful both to the researcher and the reader);

- (g) **Simulational analysis**, to show performance (this should be the major and the longest part of the paper);
- (h) **Implementational analysis**, to show complexity (for some types of research, this one could be the major and the longest part of the paper);
- (i) **Conclusion**, with the following three major elements:
 - (i1) revisiting the major contribution from the performance/complexity point of view;
 - (i2) stating who will benefit from the presented results;
 - (i3) what are the newly open problems and research avenues.
One should keep in mind that some people read only the abstract and the conclusion;
- (j) **References**, as described above.

After the skeleton on the first level of titles is defined, one should develop the skeleton on the paragraph level; this means defining all subtitles on lower levels and the contents of all paragraphs under each lowest-level subtitle. Finally, the last thing to do is to specify the first sentence of each paragraph, which is the major one; other sentences of each paragraph are just to explain and/or justify the statement conveyed by the first sentence.

It is not before now that the writing can start, and it will be easy to do it; also, this approach enables that, after the complete skeleton is developed by a senior person (e.g., a major professor), the writing can be done by a junior person (e.g., a graduate student); any errors in writing will be localized at the paragraph level, and, as such, easy to fix.

The above applies to research papers. An important prerequisite for a good research paper is that a good survey paper is prepared first, to demonstrate that major solutions for the problem of interest are known.

In the case of a survey paper, the major requirement is to have a concepts part (to define the major issues), and the systems part (to define various algorithms and/or implementations, etc.). The concepts part should be preceded by a classification of concepts. The systems part should be preceded by a classification of systems. Each system in the systems part should be

described/explained using the same template (e.g., origin, environment, essence, advantages, drawbacks, relevant details, performance consideration, complexity consideration, conclusion, trends, etc.). The choice of elements for the template is flexible. What is not flexible is that the same elements must be used in each template.

6. Semantics-Based Layout of Transparencies

Major rules for doing the transparencies can be found in numerous books. Consequently, the stress here is on an issue which is extremely important, yet not mentioned in any of the books known to this author - the rule about the semantics-based layout of transparencies. This rule reads as follows.

If a semantic entity must be spread over several lines, the breakdown of lines should be done in a semantic way. In other words, if a "bullet" is to be spread over more than one line (often times, three is the maximum which makes a good choice), each line should represent a separate thought.

As an illustration, two examples are shown next, one without and one with semantic splitting.

AN EXAMPLE **WITHOUT** SEMANTIC SPLITTING:

TOPIC TITLE

- Fixed/variable allocation scenarios based on the home property (page manager): DSM + DSIO
- Writes get satisfied on distance or locally, depending on what brings better performance
- Good if reads and writes are interleaved with similar probabilities of occurrence

AN EXAMPLE **WITH** SEMANTIC SPLITTING:

TOPIC TITLE

- Fixed/variable allocation scenarios,
based on home property (page manager):
DSM + DSIO
- Writes get satisfied on distance or locally,
depending on what brings better performance
- Good if reads and writes are interleaved,
with similar probabilities of occurrence

In other words, do not let the word-processor split the lines for you. Instead, do it by yourself, the right way! Semantic splitting is extremely useful for the audience, and its fast comprehension of the material. An experiment was performed by the author to prove that fact. In this experiment, the same subject was taught to two different groups of students, using two sets of transparencies, one with and one without semantic splitting of lines. A test would be given after the subject is completed. The experiment was repeated enough times, and the test results were considerably different, in favor of the transparencies based on semantic splitting.

As a consequence of this experiment, the author of this paper insisted that transparencies for his university courses and pre-conference tutorials are based on semantic splitting [Ekmeccic97, Protic96, Tartalja96, Tomasevic93].

Sometimes, semantic splitting seems impossible to do; however, in each such case, it turns out that an alternative way of expressing the thoughts is both easy to split and sounds much better.

7. Conclusion

This paper sets a standard for organization of research presentations, and defines the semantics-based layout of presentation transparencies. So far, almost without exception, others would start using the views expressed here (especially the semantics-based splitting for transparencies), as soon as they learn about them, which was a great source of pleasure and satisfaction for the author.

8. A Note

An earlier but wider version of this text can be found in [Milutinovic95]. For lower level details, the interested reader is welcome to contact the author directly.

9. Acknowledgments

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At last, but not least, the author is thankful to the graduate students of the University of Belgrade for their continuous efforts to educate their major professor, so he can keep up with the newest trends in the field (e.g., Jovanka Ciric, Goran Davidovic, Ilija Ekmeccic, Aleksandar Janicijevic, Milan Jovanovic, Aleksandar Milenkovic, Zvezdan Petkovic, Milena Petrovic, Jelica Protic, and Dejan Raskovic).

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- [Tomasevic93] Tomasevic,I., Milutinovic, V., "Tutorial on Cache Coherency Maintenance in Shared Memory Multiprocessors: Hardware Solutions," IEEE CS PRESS, Los Alamitos, California, 1993.

Epilog

This section includes a list with some of the author's journal papers which either helped create the research and presentation methodology which is the subject of this paper, or are based on the research and presentation methodology presented in this paper. The enclosed list includes only the papers published after 1.1.1990. and only from the prestigious IEEE periodicals.

1. V. Milutinovic,
"Mapping of Neural Networks onto the Honeycomb Architecture,"
Proceedings of the IEEE, Vol. 77, No. 12, December 1990.
2. V. Milutinovic,
"Tutorial on Microprogramming and Firmware Engineering,"
IEEE Computer Society Press, Los Alamitos, California, 1990.
3. B. Perunicic, S. Lakhani, V. Milutinovic,
"Stochastic Modeling and Analysis of Propagation Delays in GaAs Adders,"
IEEE Transactions on Computers, Vol. 40, No. 1, January 1991.
4. V. Milutinovic, D. Fura, W. Helbig,
"Pipeline Design Trade-offs in 32-bit Gallium Arsenide Microprocessor,"
IEEE Transactions on Computers, Vol. 40, No. 11, November 1991.
5. L. Hoevel, V. Milutinovic,
"Terminology Risks with the RISC Concept in the Risky RISC Arena,"
IEEE Computer, Vol. 25, No. 1, January 1992 (Open Channel).
6. M. Tomasevic, V. Milutinovic,
"Tutorial on the Cache Coherency Problem in Shared-Memory Multiprocessors: Hardware Solutions,"
IEEE Computer Society Press, Los Alamitos, California, 1993.
7. M. Tomasevic, V. Milutinovic,
"A Survey of Hardware Solutions for Maintenance of Cache Consistency in Shared Memory Multiprocessor Systems,"
IEEE MICRO (Part #1), October 1994.
8. M. Tomasevic, V. Milutinovic,
"A Survey of Hardware Solutions for Maintenance of Cache Consistency in Shared Memory Multiprocessor Systems,"
IEEE MICRO (Part #2), December 1994.
9. V. Milutinovic, Z. Petkovic,
"Processor Design Using Silicon Compilation: Ten Lessons Learned from a RISC Design,"
IEEE Computer, Vol. 28, No. 3, March 1995 (Open Channel).
10. S. Savic, M. Tomasevic, V. Milutinovic,
"Improved RMS for the PC Environment,"
Microprocessor Systems, Vol. 19, No. 10, September 1995 (A follow up paper will be published in an IEEE journal).
11. I. Ekmecic, I. Tartalja, V. Milutinovic,
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IEEE Computer, Vol. 28, No. 12, December 1995 (Hot Topics).
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IEEE Computer Society Press, Los Alamitos, California, 1996.
13. M. Tomasevic, V. Milutinovic,
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Microprocessor Systems, January 1996 (A follow up paper will be published in an IEEE journal).
14. A. Grujic, M. Tomasevic, V. Milutinovic,
"A Simulation Study of Hardware DSM Approaches,"
IEEE Parallel and Distributed Technology, Spring 1996.
15. D. Milutinovic, V. Milutinovic,
"Mapping of Interconnection Networks for Parallel Processing onto the Sea-of-Gates VLSI,"
IEEE Computer, Vol. 29, No. 4, April 1996.
16. J. Protic, M. Tomasevic, V. Milutinovic,
"A Survey of Distributed Shared Memory: Concepts and Systems,"
IEEE Parallel and Distributed Technology, Summer 1996.
17. I. Tartalja, V. Milutinovic,
"A Survey of Software Solutions for Cache Consistency Maintenance in Shared Memory Multiprocessors,"
IEEE Software, Fall 1996.
18. V. Milutinovic,
"Surviving the Design of a 200MHz RISC Microprocessor: Lessons Learned,"
IEEE Computer Society Press, Los Alamitos, California, 1996.
19. J. Protic, M. Tomasevic, V. Milutinovic,
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IEEE Computer Society Press, Los Alamitos, California, 1996.
20. I. Ekmecic, I. Tartalja, V. Milutinovic,
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Proceedings of the IEEE, August 1996.
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"Modeling of Modern 32-bit and 64-bit Microprocessors,"
IEEE Transactions on Education, 1996.
22. V. Milutinovic,
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IEEE TCCA Newsletter, September 1996.
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Conference version available from the Proceedings of the IFACT Encore-96, Belgrade, Yugoslavia, July 1996.