The 8th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications
21-23 September 2017, Bucharest, Romania

Constrained Mixed-Critical Parallelization to Distributed Heterogeneous Systems

Robert Höttger[1] , Mustafa Özcelikörs[1]
[1] Dortmund University of Applied Sciences and Arts - IDiAL Institute,
{robert.hoettger, mustafa.ozcelikors}@fh-dortmund.de, www.idial.org

***Abstract* – Distributing software effectively to multi-core, many-core, and distributed systems has been studied for decades and still advances successively driven by domain specific constraints. Programming vehicle ECUs (Electronic Constrol Units) is one of the most constrained domains that just recently approached the need for concurrency due to advanced driver assistant systems or autonomous driving approaches. In this paper, various challenges for such systems are outlined, discussed, and solutions are given upon instruction precise modeling, affinity constrained based distribution, and ... The solutions are compared upon bare-metal and OS based implementations while considering fixed priorities for sequential, OS based, and APP4MC scheduling. The latter case has been published at [?] and evolved to consider affinity constraints, SWC-based partitioning and communication cost related mapping. Results show that using APP4MC based distribution on a distributed heterogeneous system outperforms other approaches for mixed-critical applications.**

***Keywords* – component; formatting; style; styling**

I. Introduction

The automotive domain requires lots of constraints originating from different safety, security, timing, or similar requirements. The verification, validation, testing, and simulation stack requiring dozens of tools, architectures, standards, models, and assessments targets at product-line supporting, consistent, modular, and scalable software but lacks in transparency likewise the comprehensive understanding of applications. Recent approaches already address this challenge and try to provide a common adaptable platform based on AUTOSAR providing a standardized data model. Any specific commercial or proprietary tooling is supposed to be integratable in order to provide seamless interaction with provided tooling such as product-line management, requirements engineering, partitioning, mapping, testing, and more. We use the open source APP4MC environment in order to address both industrial and research related models while evaluating our new developments not only regarding model results but also to validate result among a specific use case described in section **??**. The further remainder of this paper is structured as follows: The next section **??** describes modeling Section **??** blablablbla

Identify applicable sponsor/s here. If no sponsors, delete this footnote.

This template, modified in MS Word 2007 and saved as "Word 97-2003" for the PC, provides authors with most of the formatting specifications needed for preparing electronic versions of their papers. All standard paper components have been specified for three reasons: (1) ease of use when formatting individual extended abstract, (2) automatic compliance to electronic requirements that facilitate the concurrent or later production of electronic products, and (3) conformity of style throughout a conference proceedings. Margins, column widths, line spacing, and type styles are built-in; examples of the type styles are provided throughout this document and are identified in italic type, within parentheses, following the example. Some components, such as multi-leveled equations, graphics, and tables are not prescribed.

The authors should submit a camera-ready paper of *4 – 6 pages* (in English only) using IDAACS'2015 online submission system. It should define *the scope of the work*, emphasize on new advances, theories and/or applications and include an analysis of results and findings. The paper must be structured such that the program committee will be able to understand the originality and the value of the work.

II. Ease of Use

A. Selecting a Template

First, confirm that you have the correct template for your paper size. This template has been tailored for output on the A4 (210 x 297 mm) paper size.

In case you prefer the LaTeX please use our slightly modified template IDAACS.cls based on the IEEEtran LATEX style and the IEEE bibliography template. For details on its usage, please refer to IEEEtran_HOWTO.pdf.

B. Maintaining the Integrity of the Specifications

The template is used to format your paper and style the text. All margins, column widths, line spaces, and text fonts are prescribed; please do not alter them. You may note peculiarities. For example, the head margin in this template measures proportionately more than is customary. This measurement and others are deliberate, using specifications that anticipate your paper as one part of the entire proceedings, and not as an independent document. Please do not revise any of the current designations.

III. Prepare Your Paper Before Styling

Before you begin to format your paper, first write and save the content as a separate text file. Keep your text and graphic files separate until after the text has been formatted and styled. Do not use hard tabs, and limit use of hard returns to only one return at the end of a paragraph. Do not add any kind of pagination anywhere in the paper. Do not number text heads-the template will do that for you.

Finally, complete content and organizational editing before formatting. Please take note of the following items when proofreading spelling and grammar:

A. Paper Title

In the paper title, capitalize the first letter of the first and last word and all the nouns, pronouns, adjectives, verbs, adverbs, and subordinating conjunctions (*If, Because, That, Which*). Capitalize abbreviations that are otherwise lowercase (e.g., use DC, not dc or Dc) except for unit abbreviations and acronyms. Articles (*a, an, the*), coordinating conjunctions (*and, but, for, or, nor*), and most short prepositions are lowercase unless they are the first or last word. Prepositions of more than three letters (*Before, Through, With, Without, Versus, Among, Under, Between*) should be capitalized.

B. Abbreviations and Acronyms

Define abbreviations and acronyms the first time they are used in the text, even after they have been defined in the abstract. Abbreviations such as IEEE, SI, MKS, CGS, sc, dc, and rms do not have to be defined. Do not use abbreviations in the title or heads unless they are unavoidable.

C. Units

- Use either SI (MKS) or CGS as primary units. (SI units are encouraged.) English units may be used as secondary units (in parentheses). An exception would be the use of English units as identifiers in trade, such as "3.5-inch disk drive".
- Avoid combining SI and CGS units, such as current in amperes and magnetic field in oersteds. This often leads to confusion because equations do not balance dimensionally. If you must use mixed units, clearly state the units for each quantity that you use in an equation.
- Do not mix complete spellings and abbreviations of units: "Wb/m^2" or "webers per square meter", not "webers/m^2". Spell out units when they appear in text: "... a few henries", not "... a few H".
- Use a zero before decimal points: "0.25", not ".25". Use "cm^3", not "cc".

D. Equations

Number equations consecutively with equation numbers in parentheses flush with the right margin, as in (1). To make your equations more compact, you may use the solidus (/), the exp function, or appropriate exponents. Italicize Roman symbols for quantities and variables, but not Greek symbols. Use an en dash (–) rather than a hyphen for a minus sign. Use parentheses to avoid ambiguities in denominators.

$$\lambda_i = \lim \frac{1}{p} \sum_{t=1}^{p} \ln \frac{|w_i(t)|}{|w_i(t-1)|} \tag{1}$$

Please set in Microsoft Equation following fonts: Regular — 12 pt, Large index — 7 pt, Small index — 5 pt, Large symbol — 18 pt, Small Symbol — 12 pt.

Note that the equation is centered using a center tab stop. Be sure that the symbols in your equation have been defined before or immediately following the equation. Use " (1)", not "Eq. (1)"or "equation (1)", except at the beginning of a sentence: "Equation (1) is ...".

E. Some Common Mistakes

- The word "data" is plural, not singular.
- The subscript for the permeability of vacuum μ_0, and other common scientific constants, is zero with subscript formatting, not a lowercase letter "o".
- In American English, commas, semi-colons, periods, question and exclamation marks are located within quotation marks only when a complete thought or name is cited, such as a title or full quotation. When quotation marks are used, instead of a bold or italic typeface, to highlight a word or phrase, punctuation should appear outside of the quotation marks. A parenthetical phrase or statement at the end of a sentence is punctuated outside of the closing parenthesis (like this). (A parenthetical sentence is punctuated within the parentheses.)
- A graph within a graph is an "inset", not an "insert". The word alternatively is preferred to the word "alternately" (unless you really mean something that alternates).
- Do not use the word "essentially" to mean "approximately" or "effectively".
- In your paper title, if the words "that uses" can accurately replace the word "using", capitalize the "u"; if not, keep using lower-cased.
- Be aware of the different meanings of the homophones "affect" and "effect", "complement" and "compliment", "discreet" and "discrete", "principal" and "principle".
- Do not confuse "imply" and "infer".
- The prefix "non" is not a word; it should be joined to the word it modifies, usually without a hyphen.
- There is no period after the "et"" in the Latin abbreviation "et al.".
- The abbreviation "i.e." means "that is", and the abbreviation "e.g." means "for example".

An excellent style manual for science writers is [1].

IV. Using the Template

After the text edit has been completed, the paper is ready for the template. Duplicate the template file by using the Save As command, and use the naming convention prescribed by your conference for the name of your paper. In this newly created file, highlight all of the contents and import your prepared text file. You are now ready to style your paper; use the scroll down window on the left of the MS Word Formatting toolbar.

Type the text of the paper in two columns. Balance the length of the columns, especially on the last page of the paper. Left- and right-justify your columns. Use tables and figures to adjust column length. On the last page of your paper, adjust the lengths of the columns so that they are equal. Use automatic hyphenation and check spelling. Digitize or paste down figures.

A. Authors and Affiliations

The template is designed so that author affiliation are not repeated each time for multiple authors of the same affiliation. Please keep your affiliation in as succinct as possible (for example, do not differentiate among departments of the same organization).

B. Identify the Headings

Headings, or heads, are organizational devices that guide the reader through your paper. There are two types: component heads and text heads.

Component heads identify the different components of your paper and are not topically subordinate to each other. Examples include Acknowledgments and References and, for these, the correct style to use is "Heading 5". Use "figure caption" for your Figure captions, and "table head" for your table title. Run-in heads, such as "Abstract", will require you to apply a style (in this case, italic) in addition to the style provided by the drop down menu to differentiate the head from the text.

Text heads organize the topics on a relational, hierarchical basis. For example, the paper title is the primary text head because all subsequent material relates and elaborates on this one topic. If there are two or more sub-topics, the next level head (uppercase Roman numerals) should be used and, conversely, if there are not at least two sub-topics, then no subheads should be introduced. Styles named "Heading 1", "Heading 2", "Heading 3", and "Heading 4" are prescribed.

C. Positioning Figures and Tables

Place figures and tables after they are first cited in the text. Large figures and tables may span across both columns. Figure captions should be centered below the figures; table heads should appear above the tables. Use the abbreviation "Fig. 1", even at the beginning of a sentence.

We suggest that you use a table to insert a graphic (which is ideally a 300 dpi TIFF or EPS file, with all fonts embedded) and it's caption, because, in an MSW document, this method is somewhat more stable than directly inserting a picture.

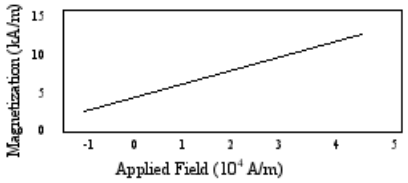

Figure 1. Magnetization as a function of applied field. Note how the caption is centered in the column.

Table I. Table Type Styles

Type Size (pts.)	Appearance		
	Regular	***Bold***	***Italic***
8	References, table header, footnotes, text subscripts, and superscripts		
9	Table captions and table names - uppercase. Table superscripts, figure captions.	Abstract, keywords	Words "Abstract" and "Keywords"
10	Authors' affiliations, main text, equations		Subheadings
11	Authors' names		
20	Paper title		

Figure Labels: Use 8 point Times New Roman for Figure labels. Use words rather than symbols or abbreviations when writing Figure axis labels to avoid confusing the reader. As an example, write the quantity "Magnetization", or "Magnetization, M", not just "M". If including units in the label, present them within parentheses. Do not label axes only with units. In the example, write "Magnetization (A/m)" or "Magnetization A[m(1)]", not just "A/m". Do not label axes with a ratio of quantities and units. For example, write "Temperature (K)", not "Temperature/K".

D. References

Number citations consecutively in square brackets [2]. The sentence punctuation follows the bracket [3]. Refer simply to the reference number, as in [4]. Do not use "Ref. [4]" or "reference [4]" except at the beginning of a sentence: "Reference [4] was the first ..."

Grammatically, they may be treated as if they were footnote numbers, e.g., as shown by Clerk Maxwell [3];

as mentioned earlier [1], [3]–[6]; Jacobs and Bean [7]; Yorozu et al [6].

Number footnotes separately in superscripts. Place the actual footnote at the bottom of the column in which it was cited. Do not put footnotes in the reference list. Use letters for table footnotes.

Unless there are six authors or more give all authors' names; do not use "et al.". Papers that have not been published, even if they have been submitted for publication, should be cited as "unpublished" [5]. Papers that have been accepted for publication should be cited as "in press" [7]. Capitalize only the first word in a paper title, except for proper nouns and element symbols.

For papers published in translation journals, please give the English citation first, followed by the original foreign-language citation [6]. If paper was published in other than English, please translate it and provide original-language title in round brackets, like in [8].

ACKNOWLEDGMENT

References and Acknowledgment headings are not enumerated. They are simply primary headings without labels, regardless of whether the other headings in the papers are enumerated.

The placement of the Acknowledgment appears after the final text of the paper, just before the References section, and after any Appendix(es).

All acknowledgment of financial support must be removed from the Acknowledgment section, and placed in the first paragraph of the first footnote.

Write the Acknowledgment section to be read in the third person. The preferred spelling of the word "acknowledgment" in America is without an "e" after the "g". Try to avoid the stilted expression, "One of us (R. B. G.) thanks ...". Instead, try "R.B.G. thanks ...".

When citing names within the Acknowledgment, use first initials only, not full names. Do not use Mr., Mrs., Ms., or Miss (list first initial and last name only). Use the Dr. or Prof. title with each name separately; do not use plural Drs. or Profs. with lists of names.

REFERENCES

[1] M. Young, *The Technical Writer's Handbook*, C. U. Science, Ed. Mill Valley, 1989.

[2] G. Eason, B. Noble, and I. Sneddon, “On certain integrals of lipschitz-hankel type involving products of bessel functions,” *Phil. Trans. Roy. Soc. London*, vol. A247, pp. 529–551, April 1955.
[3] J. C. Maxwell, *A Treatise on Electricity and Magnetism*. Oxford: Clarendon, 1892, pp. 68–73.
[4] I. Jacobs and C. Bean, *Magnetism*. New York: Academic, 1963, vol. III, ch. Fine particles, thin films and exchange anisotropy, pp. 271–350.
[5] K. Elissa, “Title of paper if known,” unpublished.
[6] Y. Yorozu, M. Hirano, K. Oka, and Y. Tagawa, “Electron spectroscopy studies on magneto-optical media and plastic substrate interface,” *IEEE Transl. J. Magn. Japan*, vol. 2, pp. 740–741, August 1987, [Digests 9th Annual Conf. Magnetics Japan, p. 301, 1982].
[7] R. Nicole, “Title of paper with only first word capitalized,” *J. Name Stand. Abbrev*, in press.
[8] *Annual Report of Research Institute of Intelligent Computer Systems*, 2009, *(in Ukrainian)*.