
Remaking ACM L^AT_EX styles

Boris Veysman

Abstract

The Association for Computing Machinery is one of the largest publishers of computation texts in the world. It publishes more than fifty journals and many more conference proceedings every year. It was among the early adopters of T_EX.

Unfortunately, over the years ACM styles accumulated many patches and haphazard changes. They diverged to the point when supporting became an impossible task. This warranted a complete refactoring.

This talk discusses the experience of rewriting ACM styles and the lessons learned.

1 Introduction

Five years ago I was asked to update BIB_TE_X styles for the Association of Computing Machinery (ACM). I did not know at that time that this commission would start a very interesting line of work.

The ACM [2] is one of the largest publishers in the computing and information science in the world. It produces dozens and dozens of journals and conference proceedings. Thus I considered the work on this assignment to be a great honor and a large responsibility.

It befits the ACM mission and traditions that it is one of the early adopters of T_EX. There are time-stamps in the ACM style files going as far back as the middle of 1980s, i.e., even predating T_EX3. As any computer specialist knows only too well, code this old requires much care and attention lest it become a crazy quilt of patches upon patches (the integrity of T_EX itself over the years is an important exception rather than the general rule). This is especially true when the code is maintained by generations of programmers stressed by deadlines and production requirements.

In the case of the ACM files, both the L^AT_EX and BIB_TE_X code and the output display the result of many temporary *ad hoc* decisions and show overlapping fingerprints of editors and coders, often with incompatible philosophies and approaches. As one frustrated T_EXpert wrote me (name withheld by request),

... 3 packages copied in with a comment (good!) that they are needed but without taking out `\endinput` that was in the code from the package copied in (bad :-)) so after the first nothing else is ever used...

1. Class files:
 - (a) `acm_proc_article-sp.cls`
 - (b) `acmlarge.cls`
 - (c) `acmsiggraph.cls`
 - (d) `acmsmall-ec13.cls`
 - (e) `acmsmall.cls`
 - (f) `acmtog.cls`
 - (g) `acmtrans2m.cls`
 - (h) `sig-alternate-05-2015.cls`
 - (i) `sig-alternate.cls`
 - (j) `sigchi-ext.cls`
 - (k) `sigchi.cls`
 - (l) `sigplanconf.cls`
2. BIB_TE_X styles:
 - (a) `ACM-Reference-Format-Journals.bst`
 - (b) `SIGCHI-Reference-Format.bst`
 - (c) `acmsiggraph.bst`
 - (d) `acm-abbrev.bst`
 - (e) `acm-alpha.bst`
 - (f) `acm-plain.bst`
 - (g) `acm-unsrt.bst`

Figure 1: Legacy code base (2015)

... and it seems there is a redefinition of startsection inside that is broken—last night 30 min before my deadline I found 3 sections dangling at the bottom of columns...

... and the footnotes are horror and the fonts too and...

...looks worse than your average Word document ...

These problems were exacerbated by the amount of copy and paste in the T_EX code. Many times over the years whenever the need arose, the original code was cloned, changed in subtle (or not so subtle) ways, and a new class file was released. At the end of 2015 I found that I was dealing with as many as 12 class files and 7 BIB_TE_X styles (Figure 1). Thus any update to the system required dozens of tantalizingly similar but slightly different changes in these files. This was not sustainable.

Another problem with the old styles was that interfaces to the elements like tables or figures were set long before the common standards were adopted. As the result, they looked quite strange for a L^AT_EX user. The unusual ways to do usual things were confusing to the authors and caused errors.

Thus, the decision of the senior staff of ACM to make a radical refactoring of the styles was excellent news. Both the typographic design and the coding were going to change. This was an opportunity to write the styles from scratch.

2 Organization of work

With many stakeholders, it took some effort to organize the writing of the styles and templates. The tasks were distributed as follows. The ACM editors updated the design and fonts selection. I wrote the \LaTeX and \BibTeX code. The company Aptara [1], which does typesetting for the ACM, developed word processor templates for the authors who do not use \TeX , as well as tools for the extraction of metadata.

Since many conference committees (SIGs) wanted to be involved in the process, \LaTeX and \BibTeX code was put in a Github repository (<https://github.com/borisveytsman/acmart>). Github-based development turned out to be quite efficient for our purposes: the testers and SIG representatives could quickly assess the changes, submit bug reports and even contribute the code. Github seems to be a mature environment for free software development.

Sometimes it was difficult to accommodate the wishes of all the stakeholders, but we tried to keep in the spirit of compromise and consensus.

3 Design features

Instead of many class files (Figure 1) we use one class, *acmart*, with options corresponding to the output version. I sincerely hope this decision (one document class with options rather than several classes) will prevent the proliferation of copy-and-paste that plagued the old styles.

As suggested by the name, *acmart* is based on the famous *amsart* class [4], so all $\mathcal{A}\mathcal{M}\mathcal{S}$ - \LaTeX advanced math typesetting features are available by default. You can use environments like `cases`, `gather` or `multline`, commands like `\dffrac` and `\tfrac` or `\text` in math mode, as well as AMS-style theorem definitions (the class itself defines several theorem-like constructs and theorem styles).

There are three journal options: *acmsmall* for small trim size journals, *acmlarge* for large trim size journals and *acmtog* for *Transactions on Graphics*, which traditionally uses two-column format. There are five proceedings options: *sigconf* for most conference proceedings, *siggraph*, *sigplan* and *sigchi* for specific proceedings with distinct formatting, and *sigchi-a* for the special SIGCHI Extended Abstract. The latter is quite unusual: it has wide margins with marginal figures and tables. Another option, *manuscript*, is for a generic manuscript.

In Figures 2, 3, 4 and 5 some examples of the output are shown. Additional samples can be found in the documentation on CTAN (<http://ctan.org/pkg/acmart>) or in your \TeX distribution.

Another important decision was to eliminate use of proprietary fonts. The Libertine fonts [6] with

A Multifrequency MAC Specially Designed for Wireless Sensor Network Applications

GANG ZHOU, College of William and Mary
 YAFENG WU, University of Virginia
 TING YAN, Eaton Innovation Center
 TIAN HE, University of Minnesota
 CHENGDU HUANG, JOHN A. STANKOVIC, and TAREK F. ABDELZAHER, University of Virginia

Multifrequency media access control has been well understood in general wireless ad hoc networks, while in wireless sensor networks, researchers still focus on single frequency solutions. In wireless sensor networks, each device is typically equipped with a single radio transceiver and applications adopt much smaller packet sizes compared to those in general wireless ad hoc networks. Hence, the multifrequency MAC protocols proposed for general wireless ad hoc networks are not suitable for wireless sensor network applications, which we further demonstrate through our simulation experiments. In this article, we propose MMSN, which takes advantage of multifrequency availability while, at the same time, takes into consideration the restrictions of wireless sensor networks. Through extensive experiments, MMSN exhibits the prominent ability to utilize parallel transmissions among neighboring nodes.

CCS Concepts: •Computer systems organization → Embedded systems; Redundancy; Robotics; •Networks → Network reliability;

Additional Key Words and Phrases: Wireless sensor networks, media access control, multi-channel, radio interference, time synchronization

ACM Reference format:

Gang Zhou, Yafeng Wu, Ting Yan, Tian He, Chengdu Huang, John A. Stankovic, and Tarek F. Abdelzaher. 2010. A Multifrequency MAC Specially Designed for Wireless Sensor Network Applications. *ACM Trans. Web* 9, 4, Article 39 (March 2010), 8 pages.
 DOI: 0000001.0000001

1 INTRODUCTION

As a new technology, Wireless Sensor Networks (WSNs) has a wide range of applications [5, 8, 13], including environment monitoring, smart buildings, medical care, industrial and military applications. Among them, a recent trend is to develop commercial sensor networks that require

This work is supported by the National Science Foundation, under grant CNS-0435060, grant CCR-0325197 and grant EN-CS-0329609.

Author's addresses: G. Zhou, Computer Science Department, College of William and Mary; Y. Wu and J. A. Stankovic, Computer Science Department, University of Virginia; T. Yan, Eaton Innovation Center; T. He, Computer Science Department, University of Minnesota; C. Huang, Google; T. F. Abdelzaher, (Current address) NASA Ames Research Center, Moffett Field, California 94035.

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 DOI: 0000001.0000001

ACM Transactions on the Web, Vol. 9, No. 4, Article 39. Publication date: March 2010.

39

Figure 2: Journal output, small trim size: *acmsmall*

newtxmath [5] give the pages a clean and crisp look. The footnotes are no longer cramped. In general, we tried to add a little air to the pages, while keeping in mind that the authors are constrained by page count limits.

One of the main principles of the design is the integrity of the interface. While the typesetting of the journals and proceedings is quite different, the interface is the same. The author should be able merely to change *acmsmall* to *sigconf* option in the `\documentclass` command in order to typeset the manuscript in a different category. The only exception are the marginal figures and tables for the *sigchi-a* option, which have no corresponding material in the other formats.

Another principle is the logical markup with most visual decisions made by \LaTeX . This can be demonstrated by the way authors' information is encoded. In the old design the authors should manually set the number of authors and align their addresses on the page using tabular-like commands. The new design does this automatically.

Since the \TeX file is used both for typesetting and for automatic extraction of metadata by Aptara

A Multifrequency MAC Specially Designed for Wireless Sensor Network Applications

GANG ZHOU, College of William and Mary
YAFENG WU, University of Virginia
TING YAN, Eaton Innovation Center
TIAN HE, University of Virginia and University of Minnesota
CHENGDU HUANG, JOHN A. STANKOVIC, and TAREK F. ABDELZAHER, University of Virginia

Multifrequency media access control has been well understood in general wireless ad hoc networks, while in wireless sensor networks, researchers still focus on single-frequency solutions. In wireless sensor networks, each device is typically equipped with a single radio transmitter and applications adopt much smaller packet sizes compared to those in general wireless ad hoc networks. Hence, the multifrequency MAC protocols proposed for general wireless ad hoc networks are not suitable for wireless sensor network applications, which we further demonstrate through our simulation experiments. In this article, we propose MMSN, which takes advantage of multifrequency availability while, at the same time, takes into consideration the restrictions of wireless sensor networks. Through extensive experiments, MMSN enables the permanent ability to utilize parallel transmissions among neighboring nodes. When multiple physical frequencies are available, it also achieves increased energy efficiency, demonstrating the ability to work against radio interference and the tolerance to a wide range of measured time synchronization errors.

CCS Concepts: •Computer systems organization → Embedded systems; Robotics; Robotics → Networks → Network reliability.
General Terms: Design, Algorithms, Performance

Additional Key Words and Phrases: Wireless sensor networks, media access control, multi-channel, radio interference, time synchronization

ACM Reference format:
Gang Zhou, Yafeng Wu, Ting Yan, Tian He, Chengdu Huang, John A. Stankovic, and Tarek F. Abdelzaher. 2016. A Multifrequency MAC Specially Designed for Wireless Sensor Network Applications. *ACM Trans. Graph.* 35, 4, Article 39 (March 2016), 14 pages.
DOI: 10.1145/2800001.2800002

1 INTRODUCTION

As a new technology, Wireless Sensor Networks (WSNs) has a wide range of applications [3, 4, 13]. In wireless sensor networks, smart buildings, medical care, industrial and military applications. Among them, a recent trend is to develop commercial sensor networks that require pervasive sensing of both environment and human beings, for example, assisted living [4, 12, 20] and smart homes [13, 12, 20].

This work is supported by the National Science Foundation, under grant CNS-0439666, grant CNS-0439666 and grant CNS-0439666. Department of Computer Science and Mary S. Woelke, A. Stankovic, Computer Science Department, University of Virginia, T. Yan, Tian He, Chengdu Huang, John A. Stankovic, Computer Science Department, University of Minnesota, C. Huang, Gang Zhou, T. F. Abdelzaher, Computer Science Department, University of Virginia, Charlottesville, Virginia, USA.

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Figure 3: Journal output, two columns: *acmtog*

SIG Proceedings Paper in LaTeX Format¹
Extended Abstract²

Ben Trovato¹
Institute for Clarity in Documentation
P.O. Box 1212
Dublin, Ohio 43017-6221
trovato@corporation.com

Lawrence P. Leipuner
Brookhaven Laboratories
P.O. Box 5000
leipuner@research.hq.ornl.gov

John Smith
The Tharvold Group
jsmith@affiliation.org

G.K.M. Tobin³
Institute for Clarity in Documentation
P.O. Box 1212
Dublin, Ohio 43017-6221
webmaster@maryville-ohio.com

Sean Fogarty
NASA Ames Research Center
Moffett Field, California 94035
fogarty@ameres.org

Julius P. Kumquat
The Kumquat Consortium
jkumquat@consortium.net

Lars Tharvold⁴
The Tharvold Group
1 Tharvold Circle
Hekla, Iceland
larst@affiliation.org

Charles Palmer
Palmer Research Laboratories
8000 Datapoint Drive
San Antonio, Texas 78229
cpalmer@prl.com

ABSTRACT
This paper provides a sample of a L^AT_EX document which conforms, somewhat loosely, to the formatting guidelines for ACM SIGS Proceedings¹.

CCS CONCEPTS
•Computer systems organization → Embedded systems; Robotics; Robotics → Networks → Network reliability.

KEYWORDS
ACM proceedings, L^AT_EX, text tagging

ACM Reference format:
Ben Trovato, G.K.M. Tobin, Lars Tharvold, Lawrence P. Leipuner, Sean Fogarty, Charles Palmer, John Smith, and Julius P. Kumquat. 1992. SIG Proceedings Paper in LaTeX Format. In *Proceedings of ACM Woodstock conference, El Paso, Texas USA, July 1992* (WOODSTOCK'92), 4 pages.
DOI: 10.1145/2800001.2800002

1 INTRODUCTION
The proceedings are the records of a conference². ACM needs to give these conference byproducts a uniform, high-quality appearance.

¹Produces the permission block, and copyright information
²The full version of the author's paper is available as `acmtog.pdf` document
³This author is the one who did all the really hard work
⁴This is an abstract footnote
⁵This is a footnote

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WOODSTOCK'92, El Paso, Texas USA
© 1992. Copyright held by the owner(s). 1234-5678-9010-11. DOI: 10.1145/2800001.2800002

Figure 4: Proceedings output: *sigconf*

SIGCHI Extended Abstracts Sample File

First Author
University of Author
Authorstown, CA 94022, USA
author1@author.edu

Third Author
Fourth Author
Lakshika Lalit
Bangalore, 560 080, India
author3@author.com
author4@author.com

Sixth Author
University of Author-Sud
Author 80222, France
author6@author.fr

Second Author
V.V. Authoring
Authoring Holdings, Ltd.
Author 2422 2991, UK
author2@author.ac.uk

Fifth Author
V.V. Authoring, Inc.
Authorstown, BC, VAM 2ZP, Canada
author5@author.com

Seventh Author
University of Author-North
Pretoria, South Africa
author7@author.ac.za

ABSTRACT
L^AT_EX'92, July 12, 1992. This sample paper describes the formatting requirements for SIGCHI Extended Abstract Format, and this sample file offers recommendations on writing for the worldwide SIGCHI readership. Please review this document even if you have submitted to SIGCHI conferences before, as some format details have changed relative to previous years. Abstracts should be about 150 words. Required:

WOODSTOCK'92, El Paso, Texas USA
© 1992 ACM. This is the author's version of the work. It is posted here for your personal use. Not for redistribution. The definitive version of record was published in *Proceedings of ACM Woodstock conference, July 1992*, http://doi.org/10.1145/2800001.2800002

WOODSTOCK'92, July 1992, El Paso, Texas USA

• Explain "insider" comments. Ensure that your whole audience understands any reference whose meaning you do not describe (e.g., do not assume that everyone has used a Macintosh as a particular application).

• Explain colloquial language and puns. Understanding phrases like "red herring" requires a cultural knowledge of English. Humor and irony are difficult to translate.

• Use unambiguous forms for culturally loaded concepts, such as times, dates, currencies, and numbers (e.g., "5:45 PM" or "5:45 PM" may mean 5 January or 1 May, and "seven o'clock" may mean 7:00 AM or 7:00 PM). For currencies, indicate equivalences: "Participants were paid W 20.00, or roughly US \$27."

• Be careful with the use of gender-specific pronouns (he, she) and other gender-specific words (Chairman, employees, men, month). Use inclusive language (e.g., she or he, they, chair, staff, staff hours, person-years) that is gender-neutral. If necessary, you may be able to use "he" and "she" in alternating sentences, so that the two genders occur equally often [10].

• If possible, use the full (extended) alphabetic character set for names of persons, institutions, and places (e.g., Großbach, Lafontaine, Sánchez, Ngwiri, Universität, Weidenbach, Zülchigebirge, Juba, etc.). These characters are already included in most versions and variants of Times, Helvetica, and Arial fonts.

FIGURES
The example on this and following pages should help you get a feel for how screen shots and other figures should be placed in the template. Your document may use color figures (see Figures 1), which are included on the page limit. The figures must be usable when printed in black and white. You can use the `natfig` figure environment to insert figures in the left margin of the document (see Figure 2). Finally, be sure to make images large enough so the important details are legible and clear (see Figure 3).

TABLES
You may use tables inline with the text (see Table 1) or within the margin as shown in Table 2. Try to minimize the use of lines (especially vertical lines). PD³ will set the table font and caption sizes correctly; the latter must remain unchanged.

ACCESSIBILITY
The Executive Council of SIGCHI has committed to making SIGCHI conferences more inclusive for researchers, practitioners, and educators with disabilities. As a part of this goal, all authors are asked to work on improving the accessibility of their submissions. Specifically, we encourage authors to carry out the following five steps:

Table 2: A simple narrow table in the left margin space.

First	Location
CHILD	22.5 Melbourne
CHILD	22.6 Singapore
CHILD	22.8 Palo Alto
CHILD	34.2 Minneapolis

Table 3: In this image, the cats are sex-related within a square frame. Images should also have captions and be within the boundaries of the sidebar on page 2. Photo: © jellish on Flickr.

Figure 5: SIGCHI Extended abstract: *sigchi-a*

```

\author{Ben Trovato}
\authornote{Dr.~Trovato insisted his name be first.}
\orcid{1234-5678-9012}
\email{trovato@example.edu}
\author{A. U. Thor}
\email{author@example.edu}
\affiliation{%
  \institution{Institute for Clarity
    in Documentation}
  \streetaddress{P.O. Box 1212}
  \city{Dublin}
  \state{Ohio}
  \postcode{43017-6221}
  \country{USA}}

```

Figure 6: Example of author information commands

tools, the commands are highly structured. For example, the authors' information is typed using the commands like `\streetaddress` or `\city` (Figure 6). There are special commands for grant sponsors and grant numbers, etc.

The class offers a number of useful features like

canned copyright statements (vetted by the ACM lawyers), review mode with line numbers printed, anonymous mode with the information about the authors, affiliations, grants and acknowledgments suppressed (for a blind review), etc. This anonymous mode is just one of the options for conditional typesetting: the authors could also have different versions for the online and hard-copy; for example, the online version could include supplementary materials. There are provisions to include CCS “concepts”: hierarchical keywords generated by the ACM website.

The class uses standard L^AT_EX 2_ε interfaces to common elements, such as figures and tables, as much as possible. The only area with ACM-specific commands is the front matter: unfortunately all publishers use their own systems to indicate the authors and their affiliations, and ACM is no exception here.

4 Bibliography

Historically some ACM publications used author-year citations, while other used numbered cites. Even the author-year ones were not uniform: some used *natbib*, while some used their own interface. There were pervasive differences in bibliography formatting. This led to a large number of “official” ACM BibT_EX styles (see Figure 1).

The new *acmart* package uses only one BibT_EX style, which is *natbib*-compatible and defaults to numeric citations. Fortunately, the *natbib* package [3] allows the user to choose either author-year or numbered citations, thus allowing SIGs to customize their bibliographies. Even when the citation style is numeric, commands like `\citeyear` and `\citeauthor` are allowed.

Another interesting feature of the citation style is that the bibliographic output is highly structured for use by the cross-referencing software. This is done transparently to the user, creating the entries like the one shown on Figure 7.

5 Conclusions and acknowledgments

This large work of creating the new ACM styles would not be possible without the help of many people. I would like to express my gratitude to:

- ACM editors: Craig Rodkin, Bernard Rous.
- Aptara: Neeraj Saxena, Sehar Tahir.
- Testers, users and SIG representatives: Chris Guccio, Wayne Graves, Matthew Fluett, Jofish Kaye, Frank Mittelbach, John Owens, Tobias Pape, David A. Shamma, Stephen Spencer.
- Authors of the early versions of ACM T_EX and BibT_EX styles.

```
\bibitem[\protect\citeauthoryear{Akyildiz,
Melodia, and Chowdhury}{Akyildiz
et~al\mbox{.}}{2007}]{%
{Akyildiz-02}
\bibfield{author}{\bibinfo{person}{I.~F.
Akyildiz},
\bibinfo{person}{T. Melodia}, {and}
\bibinfo{person}{K.~R. Chowdhury}.}
\bibinfo{year}{2007}}.
\newblock \showarticletitle{A Survey on
Wireless Multimedia Sensor Networks}.
\newblock \bibinfo{journal}{\em Computer
Netw.\\/}
\bibinfo{volume}{51}, 4},
\bibinfo{pages}{921--960}.
```

Figure 7: Bibliography entry made by the new ACM bst file

The new ACM styles are available on CTAN and the ACM web site, as well as in the major T_EX distributions like T_EX Live and MikT_EX.

As mentioned above, development is hosted at Github, <https://github.com/borisveytsman/acmart>. The Github interface is the best way to send me bug reports or feature suggestions.

References

- [1] Aptara. <http://www.aptaracorp.com>.
- [2] Association for Computing Machinery. <http://www.acm.org>.
- [3] Patrick W. Daly. *Natural Sciences Citations and References (Author-Year and Numerical Schemes)*, 2010. <http://ctan.org/pkg/natbib>.
- [4] Michael Downes and Barbara Beeton. *The amsart, amsproc, and amsbook document classes*. American Mathematical Society, 2015. <http://ctan.org/pkg/amsart>.
- [5] Michael Sharpe. *New TX font package*, 2016. <http://ctan.org/pkg/newtx>.
- [6] Bob Tennent. *L^AT_EX Support for Linux Libertine and Biolinum Fonts*, 2014. <http://ctan.org/pkg/libertine>.

- ◊ Boris Veytsman
Systems Biology School and
Computational Materials
Science Center
MS 6A2
George Mason University
Fairfax, VA 22030 USA
`borisv (at) lk dot net`
<http://borisv.lk.net>