

## A Short Guide to Writing Technical Papers: A Company Perspective

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Writing a book or a paper is often associated with scholars' activities. After all, scholars leave a legacy of literature to be read by later generations. This exchange of ideas is best served by the work being made available in the public domain. This mindset rules in academic circles, where a culture of "publish or perish" has taken hold. On the other hand, engineers working in profit-oriented companies often view publishing in journals as a free-time "nice-to-have". Such engineers pride themselves on solving problems to save or earn money for their companies. Writing papers is "for academicians". This mindset presents unique challenges to aspiring writers working in companies. This paper looks at five questions related to the activity of writing and publishing amongst engineers: "Why, Where, When, What and Who". Answering these five questions will go a long way towards providing a framework for engineers to write in a company environment. The paper also cites an established protocol – the Vancouver Protocol - used to determine authorship for any publication.



**“Why should I write the paper?”** This is the first question engineers will ask themselves, often feeling that they should have left the writing of papers (or ‘term papers’) after graduating from university. Engineers are supposed to get their hands dirty solving “real” problems. That is the mantra drilled into engineers’ heads all over the world. At least, that is what a career mentor will advise an engineer working in a company. But writing and publishing papers gives visibility to the author, and may get him noticed by company management.

In many cases, the manager approving an engineer’s promotion is not located in the same building as the engineer. The manager may be located in another country or know of the engineer solely through the paperwork landing on his desk. A published paper in a reputable conference or journal gives instant credibility to the engineer’s work. A published paper would normally have gone through a rigorous review process, which functions as an endorsement of the quality of work.

What better way to tell your peers what you are working or doing research on than by sending them a published paper? After all, such a paper is the only legitimate way to tell anyone outside your company what you are working on without breaking the strictures of confidentiality. Your paper will also put you in touch with researchers everywhere who are interested in your field.

Writing a paper also helps to clarify missing links or thoughts in the research or development process. As you can write up your work, you are more likely to spot mistakes and correct them on your own. If the resultant paper is sent for review by a journal, no fewer than two experts in your area will go through your work to assess its merit.

Companies are also motivated to ask their employees to publish papers because such published materials can be used as marketing materials. Imagine the difference in perception when you read a paper published in a reputable journal versus a glossy advertisement in a magazine extolling the same product. While the audiences accessing these two publications may be different, a published paper instantly brings credibility to the content. An advertisement is a paid service, versus the objective assessment required for acceptance in a reputable journal.

Regular publication in conferences or journals helps a company shape the direction of development so as to benefit from it. For example, the company can pioneer a proposed common standard or qualification test for a particular technology. As the pioneer, the company will naturally have a first-mover advantage in setting a high barrier to prevent newcomers entering the game.



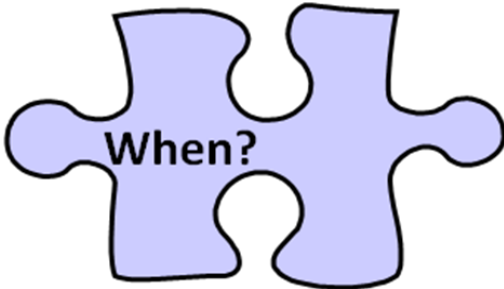
**“Where to publish?”** is another natural question. There are two main avenues to publishing one’s work: conferences and scientific journals. Major conferences are held throughout the year in different parts of the world. The Electronics Packaging Technology Conference in Singapore and Electronic Components and Technology Conference in the USA are two well known examples for those working in the microelectronics field.

Travelling to exotic places is one of the perks of publishing papers in research conferences. More important is the opportunity to meet like-minded individuals from the same field, to exchange ideas, share new findings and perhaps set new directions for the industry. Authors must look at the editorial policies of the conference organizers and submit the papers accordingly. Format, paper length and conference focus differ substantially from one conference to another. Conforming to these rules and regulations are prerequisites for acceptance and publication.

Writing for a scientific journal is another avenue for sharing one’s findings. This approach can be more cumbersome due to its stricter reviewing process, but journals normally reach a larger audience. Not all journals are created equal: They differ in scope, target audience, impact factor etc. ‘Impact factor’ aims to quantify the influence or impact of the journal by dividing the number of citations in previous two years by the number of papers published within that period. An insightful paper in an emerging area of a widely-read journal is likely to attract numerous citations. Naturally, a “high impact’ journal should be the publication medium of choice for any researchers worth their salt. An equally important criterion is the target readership of a journal. A company-based engineer should consider this factor carefully because he would want his readers to care about his findings and their significance. Unlike academic researchers who need to publish in high impact journals to continue receiving research funding, a company-based researcher can afford to be more selective and instead look at the readership more carefully. The right audience will attract the right stakeholders to advance this area of research and development quickly for commercialization and mass adoption.

Besides original research papers, a company-based researcher can also write a review paper which generally comments on developments in his field, summarizing key breakthroughs and speculating on its future directions. In the past, such review papers were often invited papers written by established scientists. However, the current proliferation of journals seeking contributions from authors has resulted in plentiful opportunities for aspiring authors to publish in this genre.

Another type of journal paper is the short letter responding to earlier papers published in the same journal. Again, this “letter”-style paper calls for certain skills and in-depth knowledge because the letter must point out a critical flaw in an earlier published paper; a critical flaw that changes the conclusion of the paper. Unless the letter’s authors know the topic very well, they are unlikely to point out such far-reaching errors.

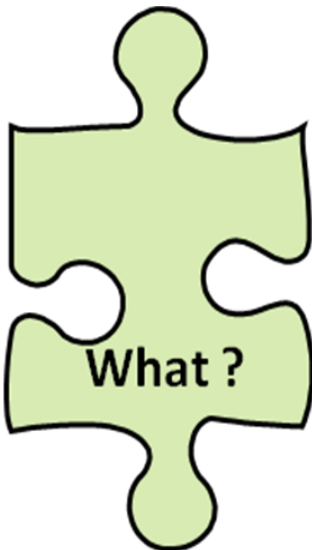


### When do I publish the paper?

Another part of the puzzle for company-based writers is determining **the timing for publishing their papers**. Companies spend millions every year to develop new products and competencies. Naturally, they would want a return on their investment, and not give any hard-won advantages away.

Hence, it is natural that many publications in the literature that originate in company research contain coded numbers instead of actual process parameters. Any published paper must contain useful information which justifies its publication in a conference or journal. So, engineers have to thread a fine line between publishing work which is of interest to the scientific community and divulging company secrets. Fortunately, most companies have established protocols to handle such dilemmas. If these strategies are applied judiciously, publication can be a powerful weapon to protect the company intellectual property. Publication of work deemed too difficult to be successfully prosecuted in the patenting process can prevent others from doing likewise; it is a case of “if I can’t own it fully, nobody can have it either”.

Under normal circumstances, a company will initially file a patent for an invention and then allow publication after the patent information become public domain following the expiry of the mandatory blackout period of 18 months under US patent laws. Publication and dissemination of inventive steps before the patent application is fully prosecuted can be used by the patent office to invalidate the patent application even if the authors and the inventors are the same person. The only exception is for inventions filed in US Patent and Trademark Office, which allows filing up to 12 months since public disclosure.



This conundrum naturally leads to the next question: “**What can be published in the open literature?**” We often feel that we need to have achieved a research breakthrough before we can publish. But there is no such requirement. In general, editors and reviewers are looking for how a submitted paper can contribute to the existing pool of knowledge in a timely manner. As mentioned earlier, this contribution must be balanced against a company’s desire to not accidentally disclose know-how or confidential information that compromises its competitive edge. Materials compositions, design architecture and processing conditions are typically kept confidential; this approach may not rest well with reviewers who is looking for enough information for the experiments to be repeated elsewhere, thereby validating the proposed hypothesis.

Another pressing issue during publication is who owns the copyright on figures, diagrams or charts created during the collaboration between company and supplier. The same issue applies when engaging third party service providers to perform certain tasks or analysis. In most circumstances, service providers do not own the copyright to the work unless this is indicated otherwise in the contract. Hence, sufficient time must be allocated to obtaining the necessary permissions from all stakeholders before the paper is submitted for review.

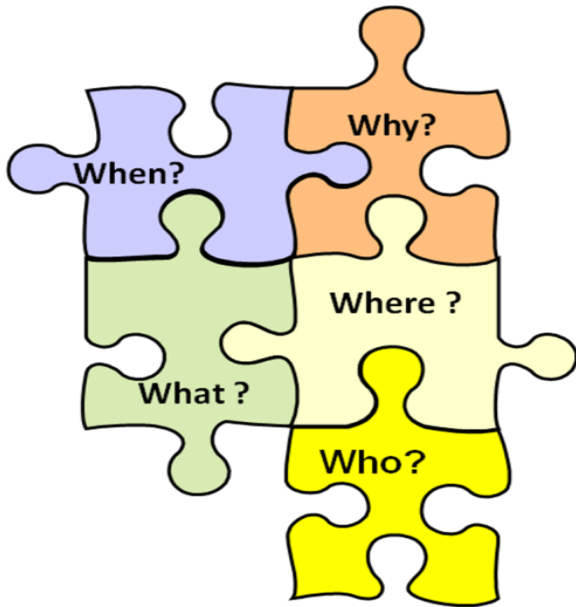
A company-based engineer must also pay attention to the reference section of his published paper. While patents and patent applications are rich sources of information, citation of such documents in open publications is typically discouraged by company patent attorneys. Such citations can be used as evidence in court to show that said company is willfully infringing on other patents if its technologies are later found not to be substantially different from the cited patents. Instead, company-based engineers tend to cite previous publications from their own companies; the citations would show developments in the same field and the writers whose work is cited would be proud of their work.



### **Who should be considered the author of a paper?**

If publication is so important to engineers' careers, all engineers would want to append their names to a published paper. However, credible researchers do not want their names to be associated with every piece of work churned out by their company. Credible researchers only want to be associated with work in which they are directly involved, so that they would be willing to take the attendant public responsibilities. The history of scientific fraud is replete with ambitious researchers who are not willing to put in the hard work needed to produce results, but resort instead to cheating. In the past 10 years, Schon's organic semiconductor and Hwang's stem cell

scandals come to mind. Almost all journal publishers adopt the Vancouver Protocol, which stipulates the following conditions for authorship of publication: "1) substantial contributions to conception and design, acquisition of data, or analysis of and interpretation of data; (2) drafting the article or revising it critically for important intellectual content; (3) final approval of the version to be published". With these clear guidelines, researchers can recruit the right members for their teams: Researchers willing to put in their fair share of sweat to be part of the action, and to take public responsibility for it.



## Conclusions

In this paper, the author attempts to address the five main questions related to writing and publishing a paper for an engineer based in a company: The 'why', 'where', 'what', 'when' and 'who'. Unlike a university which is likely to be funded by public money for the benefit of society or humanity, a profit-oriented company may not promote publishing activities as enthusiastically as the former. The author examines these five issues in depth and remains convinced that company-based engineers have an equally important role in contributing papers for publication. Both

company and authors stand to gain from publication of their work through furthering career progress and customers' mindshare. There are avenues aplenty to publish one's work. However, company-based engineers need to exercise some care in selecting what and when to publish their work, and must not divulge company secrets or jeopardize any patent applications by their company. Having argued that the company environment is suitable for publishing, the author cites the Vancouver Protocol as the criterion for authorship in any published paper. Clear guidelines will maintain the cordial working environment amongst engineers in a company.