How to Write a Good (Systems) Paper

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What is “Systems”?  

(Overly?) simplified view of Computer science: theory + systems  
- Theorists build theories, models  
  - often get away with theories not good for anything  
- Systems folks build stuff  
  - don’t get away with work not good for anything!  

Examples of “systems” work:  
- operating systems  
- network systems / distributed systems  
- database systems  
- programming systems (PL implementation)  
- machine-learning systems  
- …
Disclaimers

1. This is about good papers, not exciting talks slides 😊
   – … didn’t have the time to do a fancy slides (and rarely do!)
   – don’t take these slides as a model!

2. I’ve been around the traps longer than you, but I don’t know it all!
   – I get papers rejected just as you do
   – 2013 stats (a very good year!):
     • 11 accepts:
       – 6 conferences: EuroSys, SIGMOD, SOSP, OOPSLA, 2*RTAS
       – 4 workshops: HotOS, APSys, PLOS, HotPower,
       – 1 journal: TOCS (plus TODS invite)
     • 8 rejects: 2*Usenix, PLDI, 2*RTSS, APSys, EMSOFT, RTAS

3. There are plenty of other resources addressing similar issues
   – Examples at the end
RULES OF WRITING
Rule 1: Reviewers are Pot Luck

• ... even at top conferences
  – even good papers get rejected, sometimes for the wrong reasons

• Rejection is part of life, get used to it!
  – Don’t blame the reviewers, it usually means you didn’t do your job!

• Reviewers’ top reasons for rejection
  – I’m not convinced you’re solving a real problem
  – I’m not convinced you’re solving the problem
  – I don’t understand – your paper is too badly written
  – Your paper is just not competitive for {SOSP, OSDI, EuroSys…}

• Papers without a PC “champion” have a hard stand
  – Make sure there’s something which at least one reviewer will think cool
  – Purely incremental work will have a hard stand at top venues
Rule 2: A Paper has a Story

1. The paper has a (one!) main message
   - Understand clearly what the message is
   - Make sure that the reader gets it
   - Make sure it’s an interesting one

2. A paper has a narrative
   - It starts from zero and then works on transmitting the message
   - *Everything* you write must support the message
   - *Maintain user state!*
     - be conscious of what the reader knows/remembers
Rule 3: Limited Real Estate: The Two “C”s

- Be **clear** (at all levels)
  - every sentence, paragraph, section has a clear purpose
  - the purpose is clearly communicated
  - the overall message is consistent

- Be **concise** (brief but complete)
  - don’t waffle!!! (Use “Jay’s rule of thumb”)
  - be precise
  - make sure it’s readable, lucid, enjoyable

But:
- maintain reader state:
  - define before use
  - be aware of what the reader has learned
  - recall/remind if necessary
Rule 4: Presentation Matters – Paper Engineering

The best work is useless if you can’t convince the reviewers

• Reviewers are busy, may have to review 30 papers in 6 weeks
• They’ll look for reasons to reject – don’t give them any!

Important bits:

• Introduction: sell the idea, the significance and the approach
• Build tension, make reader interested
• Convincing argumentation
• Top-down, not bottom-up
• Maintain reader state
• Convincing evaluation
  – thorough and honest
• *State assumption/limitations honestly*
PAPER STRUCTURE AND STYLE
Introduction: Most Important Part of the Paper!

The Overture:

- Explain the problem you’re solving
- Outline your approach
- Indicate results/outcomes
- State contributions

General hints for intro:

- Capture the reader’s interest: sell your idea
- Be concise: Stay within about one page!
- Make sure the paper delivers what you promise
  - Reviewers kill for “bate and switch”
Other Parts

• Background: set the scene in more detail
  – Cite related work as needed, don’t discuss more than necessary
  – Examples!!!!
• Describe problem in detail
• Explain solution in detail
  – Be honest and forthcoming with limitations and assumptions
• Evaluation: often largest part
• Related work
• Conclusions
• Abstract
  – Used to steer to the right reviewers!
  – What, Why, Achievement, Implication
  – IMPORTANT: Redo for camera-ready!
Evaluation

• Show that your solution actually works
  – *Progressive*: significant improvements in important situations
  – *Conservative*: no (or insignificant) degradation elsewhere

Need both!

• Be careful about the scenarios you benchmark
  – Artificial/construed best cases will be discounted
  – Think of ways in which your approach could fail/deteriorate
  – Go out of your way to be fair, anticipate any scepticism of your work

• Avoid benchmarking crimes!

• More on this in my separate benchmarking talk
Style and Form

• Write in engaging style, lead reader though the paper
  – Avoid bottom-up structure, present ideas top-down
  – Follow style rules
  – *Use active voice!!!!*
  – Avoid buzzwords (“novel”, “mobile social supercomputing in cloud”)

• Be mindful of reader’s brain state (which is lossy)
  – *Maintain reader state*
  – Don’t assume every reviewer is expert in your narrow area
  – But don’t think you can hide stuff from reviewers!

• Follow formatting rules
  – Don’t play with margin, baseline skip etc
  – Don’t use microscopic fonts, >40y olds have problems with <8pt font

• Spell-check, proof-read, proof-read
  – Get native speaker to proof-read if you aren’t
  – Get outsider to read it – great way to spot holes before it’s too late!
Mechanics

• Use revision control
  – Especially (but not only) when it’s a joint paper

• Don’t use MS Word
  – Doesn’t integrate well with revision control
  – Requires coarse-grain locking, limits concurrency of writing!
  – References are painful, formulae even more so
  – MSR people use LaTeX, so should you!

• Use BibTeX
  – … but use it correctly
Further Reading

- Levin & Redell: An evaluation of the 9th SOSP submissions, or How (and how not) to write a good systems paper
- Simon Peyton Jones (MSRC): How to write a great research paper
- My paper/thesis writing guide
- My page of benchmarking crimes
  - [http://gernot-heiser.org/benchmarking-crimes.html](http://gernot-heiser.org/benchmarking-crimes.html)
Thank You!

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