HOW (OR HOW NOT) TO WRITE A GOOD SYSTEMS PAPER

- Adopted "*An Evaluation of the Ninth SOSP Submissions*, Prof. R. Levin and D. D. Redell"
- Partially adopted "*How to write a good (systems) paper*, Prof. Gernot Heiser"

2017 Operating Systems Design

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9th SOSP Review

- PC meeting on March 21, 1983
  - Ten committee members
- Selected 16 papers out of 83 submissions
  - Somewhat lower than in recent years
- It was surprisingly easy to dispose over 80% of papers
  - Most were rejections
- Many of rejected papers exhibited similar weakness

About Reviews

- Reviewers are potluck, even at top conferences
  - Even good papers get rejected, sometimes for wrong reasons
- Rejection is part of life, get used to it
  - Don't blame 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

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
  - Etc.

Classes of Papers

- Three categories
  - Presents a real system
    - Global survey of an entire system
    - Selective examination of specific themes embodied in a system
  - Presents a system that is unimplemented but utilizes ideas or techniques that you feel the technical community should know
  - Addresses a topic in the theoretical areas
    - E.g.) Performance modeling or system verification

Criteria for Evaluation of Submissions

- Original ideas
- Reality
- Lessons
- Choices
- Context
- Focus
- Presentation
- Writing style

Ideas, Original Ideas

- A paper has a (one!) main message
  - Understand clearly what the message is
  - Make sure that the readers get it
  - Make sure that it's an interesting one
- Your message (or idea) must be new
  - You must be familiar with the state of the art research in the area covered by your paper
- Can you state the idea concisely?
  - Try writing each idea down in a paragraph that someone generally versed in the relevant area can understand
  - If you can't, you don't understand what your idea
  - If you can, use it in the abstract of the paper

Ideas, Original Ideas

- Be sure to explain why your problem couldn't be solved just as well by previously published techniques
- Are the ideas significant enough to justify a paper?
  - "I've spent two years to build this. you must know how difficult to implement this." don't work
  - How innovative and effective is your idea?
  - You must show that your work represents a significant departure from the state of the art
    - All related work should be referenced to show this
    - You should actually read cited material
    - Nightmare scenario: Reviewers read related papers and you didn't

Ideas, Original Ideas

- Comparisons with previous work should be clear and explicit
  - You cannot simply say "Our approach differs somewhat from that adopted in the Bagofbits System [3]"
  - Be specific "Our virtual memory management approach uses magnetic media rather than punched paper tape as in the BagOfBits system [3], with the expected improvements in transfer rate and janitorial costs"
- Implementation experiences supporting or contradicting a previously published paper design are extremely valuable and worthy candidates for publication
  - Designs are cheap, but implementations (particularly those based on unsound designs) are expensive

Ideas, Original Ideas

- Qualification of citations
  - Recent references show that your research deals with a hot topic
  - Papers with only recent references often "rediscover" (through ignorance) old ideas
  - Personal communications and internal memoranda fail

Reality

- Reviewers are very skeptical of design-only papers unless there are new ideas of obviously high quality
- Does your paper describe something that has actually been implemented?
  - Don't pretend that your system has been already built when it has not
  - Your reader has a right to know at the outset whether the system under discussion is real or not
- It is important to explain how your idea worked out in practice

Lessons

- What have you learned from the work?
  - If you didn't learn anything, it is a reasonable bet that your readers won't either
- What should the readers learn from your paper?
  - Spell out it clearly
- How generally applicable are these lessons?
  - Be sure to state clearly assumptions on which your conclusions rest
  - Don't generalize from a single example
  - When stating your conclusions, it helps to state the assumptions again
    - The reader may not have seen them for fifteen pages and may have forgotten them. You may have also.

Choices

- What were the alternatives considered at various points, and why were the choices made the way they were?
  - Don't describe, explain
- Record what you have experienced to make a right choice and what you have learned during that
  - Many papers present a rational argument from initial assumptions all the way to the finished result when, in fact, the result was obtained by an entirely different path and the deductive argument fashioned
    - This kind of "revisionist history" borders on dishonesty and prevents your readers from understanding how research really works

Context

- What are the assumptions on which the work is based?
  - Make sure you get them all
  - It's easy to overlook implicit assumptions
- Are they realistic?
- How sensitive is your work to perturbations of these assumptions?
- Don't build a tall tower on a fragile assumptions

Focus

- "Real system" papers are particularly guilty of irrelevant description
  - Be especially careful when you write the introductory part
- Avoid the temptation to describe all major characteristics of your system at the same level of depth
  - Concentrate instead on the novel or unusual ones that (presumably) will be the focus of the original technical content of the paper
- Include just enough material from previously published works to enable your reader to follow your thread of argument
  - Do not assume that the reader has read every referenced paper within the last week and has them at his fingertips for instant reference
  - We adopt the definition of transactions from Brown [4], layering it onto files as described by Green [7, 18], with the notions of record and database introduced by Black [10] and White [12] and later modified by Gray [6]
  - Don't burden your reader unnecessarily with lengthy extracts or paraphrases from cited works

Presentation

- Repeatedly ask yourself followings
  - Are the ideas organized and presented in a clear and logical way?
  - Are terms defined before they are used?
  - Are forward references kept to a minimum?
    - Give the reader enough information to attach some meaning to the forward-referenced term
  - Have alternate organizations been considered?
  - Was an abstract written first? Does it communicate the important ideas of the paper?
- Reviewer cannot tolerate the omission of important explanation or justification
- Build tension, make reader interested
- Top-down, not bottom-up

Writing Style

- Ask your self after writing up
  - Is the writing clear and concise?
  - Are words spelled and used correctly?
  - Are the sentences complete and grammatically correct?
  - Are ambiguity, slang, and cuteness avoided?
  - Remember that you are asking a favor of your reviewers
- 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!

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

Other Parts

- Background
  - set the scene in more detail
  - Cite related work as needed, don't discuss more than necessary
- 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

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 skepticism of your work
- Avoid benchmarking crimes

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!
  - Make a mutual-aid society for peer-review

Machanics

- 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
- Use BibTeX
  - ... but use it correctly