How to Develop a Bad Research Tool

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DArchR

DAVIS ARCHITECTURE RESEARCH

Outline

- My opinions/experience

- Advice for Developing Bad Tools
- Advice on Alternatives to Bad Tools

- Things the community can do to encourage good tools

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Define “tool”

- Software/testbed used in research
  - AKA “Infrastructure”
  - AKA “Artifacts”
- Stuff needed to generate data for a paper
  - Or to prototype an idea
- Architecture: Simulators, emulators, FPGA designs, actual chips
- PL, OS, etc. have similar things

- **What we spend most of our time on**

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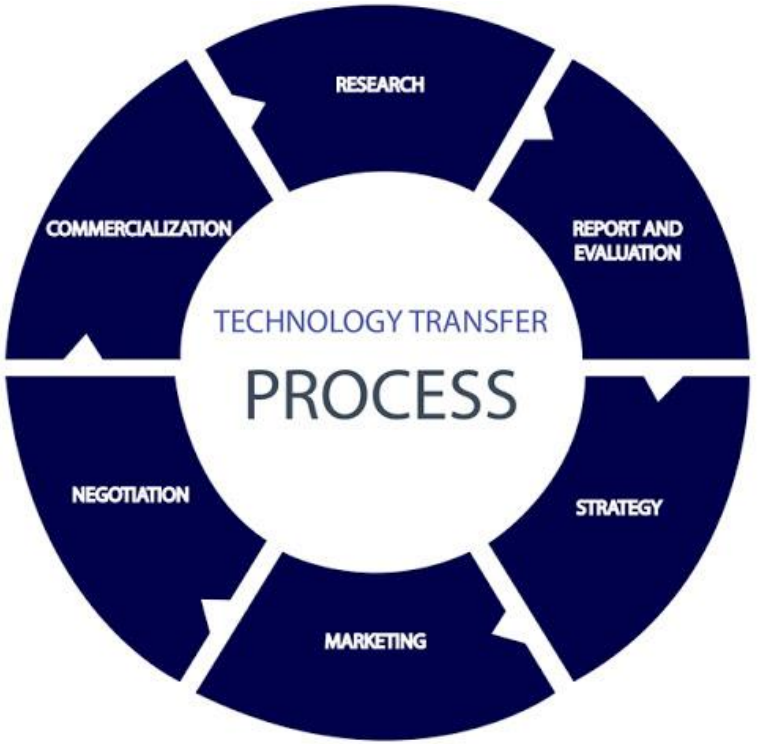
Goal of a good research tool

IMPACT

Scholar

10,000

☆ ❞ Cited by ~~4346~~ Related articles



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How to develop a bad tool

Some tips and tricks

Create “in-house” tools

- The idea is good enough to have impact on its own!
- Others can easily build on to of your ideas
  - It’s simple to recreate all of the details
    (it only took you a couple of weeks to build, right?)
  - Funders love to pay to recreate others’ work
- There’s no need for anyone to reproduce your results
  - Why wouldn’t they trust you? You never make mistakes
- Keeping it in house gives you a competitive advantage
  - Research is a competition and a zero-sum game

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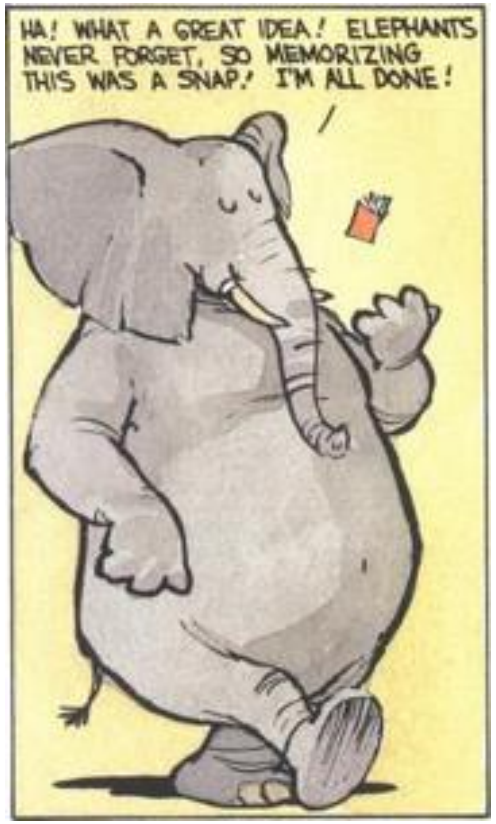
Don’t follow software best practices

- No one will see your code
  - It’s OK that the code is ugly
  - “Research-quality” code is a thing, right?
  - Monolithic designs are best!
- Who needs version control?
  - You never make mistakes
  - Your hard drive will never die
- Don’t write tests or validate
  - You’ll never add back a bug you squashed
  - No need to check to make sure you model is good
- Don’t write documentation
  - You’re the only one who will ever use this tool anyway
  - You’ll remember all of these details in 3 years, no problem



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Make the tool “open source”

- Force people to register before giving code
  - If someone really wants your code, they’ll ask
  - Everyone loves registering and waiting for permission
- Provide a tarball of the source
  - With the source anyone can build and use the tool
  - Why would anyone need anything more than the source?
- Don’t provide a license or use a restrictive license
  - Clearly you own all rights to the code
  - Or, it’s “open source” so obviously it’s OK to use
  - GPL is great because it forces others to be open source (🔥🔥🔥)

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Don’t market your tool

- No need to come up with a good name
  - Common English words are memorable
  - Someone else thought the name was good, let’s copy it!
- Don’t create a webpage
  - Domain names are expensive, and IT is mean
- No need to provide context beyond the paper
  - Research papers are great documentation
  - People love reading PDFs behind paywalls

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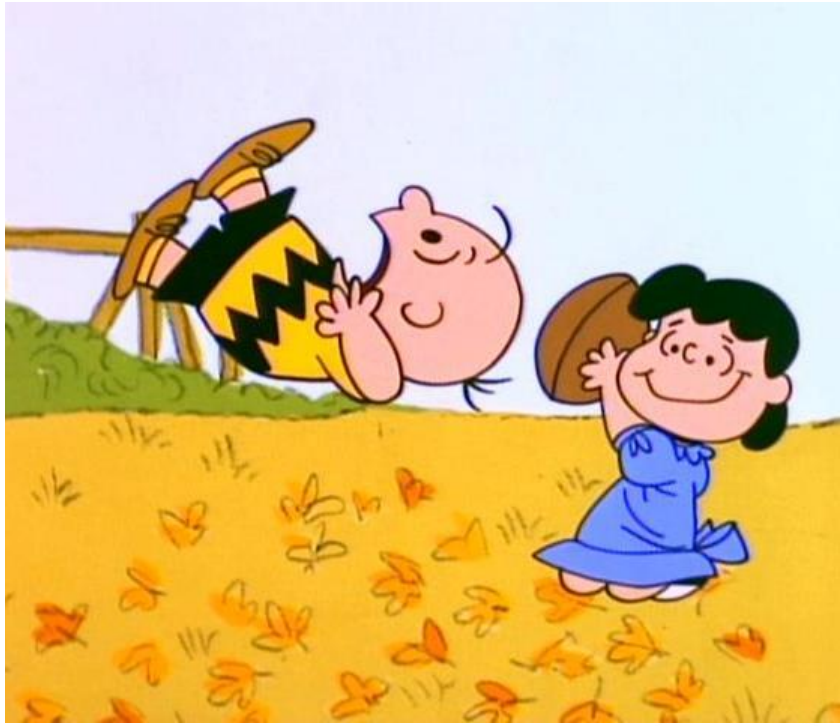
Stop supporting the tool

- Once your paper's published, no need to continue working on the tool
  - You've gotten everything you need out of it
  - Since the paper is accepted, the tool must be perfect
- No one will need help using your tool
  - You wrote a perfect tool, there can't be bugs
  - The documentation you wrote is perfectly clear
- People love links to dead webpages
  - Extra points if it looks like your webpage was created in 1995



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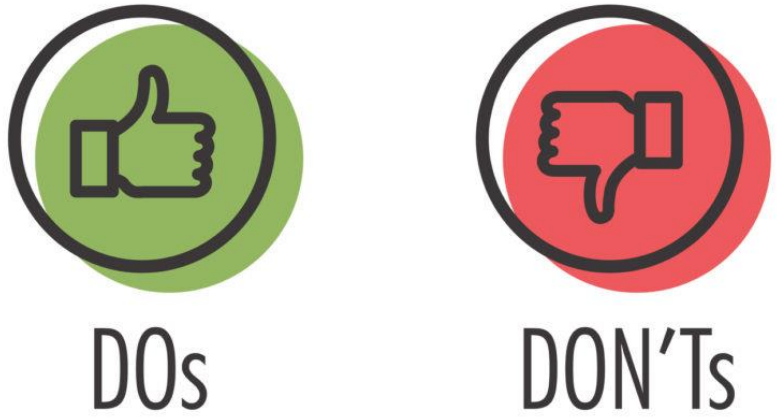
How **NOT** to develop a **bad** tool

- **Do** share your tool: **Let others use and develop**
  - **Do** share your tool as widely and easily as possible!
  - **Do** make your tool open source
  - **Market** your tool anywhere and everywhere
    Websites, tutorials, books, videos, etc.
- **Do** follow software best practices: **Make it easy for others to use your tool**
  - **Do** use git, good design practices, …
  - **Do** use agile development practices, code review, …
  - **Do** use the most popular tools for your tool
- **Do** support the tool: **Help others use your tool**
  - **Do** provide documentation and support
  - **Do** continue development after initial release



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Make the tool Capital **O**pen **S**ource

- Include a LICENSE file with all distributions
- Use an OSI approved license (opensource.org)
  - Industry prefers more permissive licenses
  - Apache v2, BSD are good choices
  - Use creative commons for documentation / teaching
- As the project grows, the leadership should mature
  - Governance document defining how to make decisions
  - Committee for management
- Think about the exit strategy
  - Without an exit strategy the project will languish
  - Moving under an umbrella
  - Startup, nonprofit, etc.

open source initiative®

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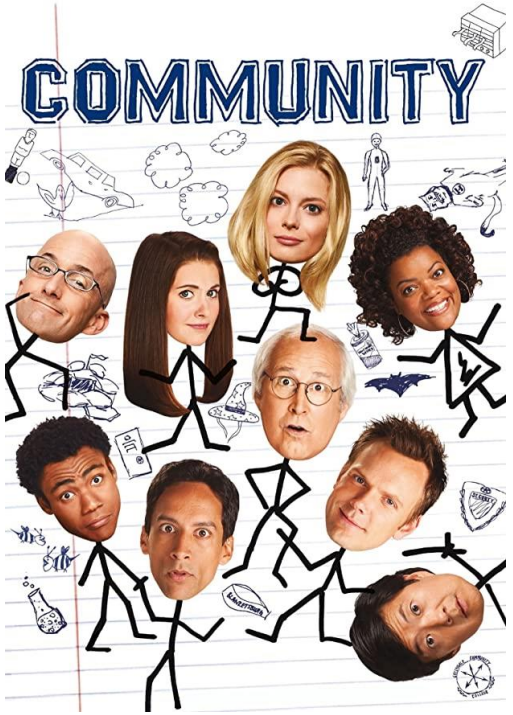
Create a community around a tool

- Foster a community so that others can give back
- Answer questions when they come up
  - Mailing list, github issues, slack, etc.
- Provide answers to questions *before* they come up
  - Documentation is hard, but *very* important
  - Document for both users and developers
  - readthedocs.org is a great tool
- Include a CONTRIBUTING guide and a CODE-OF-CONDUCT
  - Make the community *inclusive* and *accepting*
  - The broader the community the more impact the tool will have



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But how? (From academia)

- (Research) Incentive structure pushes us towards bad tools
  - Bean counters, not fertile soil counters
  - Need more recognition:
    - Infrastructure papers?
    - Awards? Artifact badges are a great start!
    - Count commits? Code reviews? Stackoverflow posts?
- Funding is for *research* not infrastructure
  - 3-year grant: papers published in years 2&3
  - The experts (students) graduate or end their internships
  - Need more “lab techs” in systems research
    - Software developers to provide continuity
    - Continuing infrastructure development funds

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But how? (“Successful” projects)

- What do these projects have in common?
  - *Significant* industry uptake and support
  - Most development comes from industry

https://events19.linuxfoundation.cn/wp-content/uploads/2017/11/Bringing-an-Open-Source-Project-to-the-Linux-Foundation-LC3-2018.pdf

Virtuous cycle for research?

The Answer: Projects With Sustainable Ecosystems

Sustainable projects have a developer community whose technology is used in [illegible]s that [illegible] who in turn participate and reinvest back into the project and hire [illegible] to work in the community.

research projects

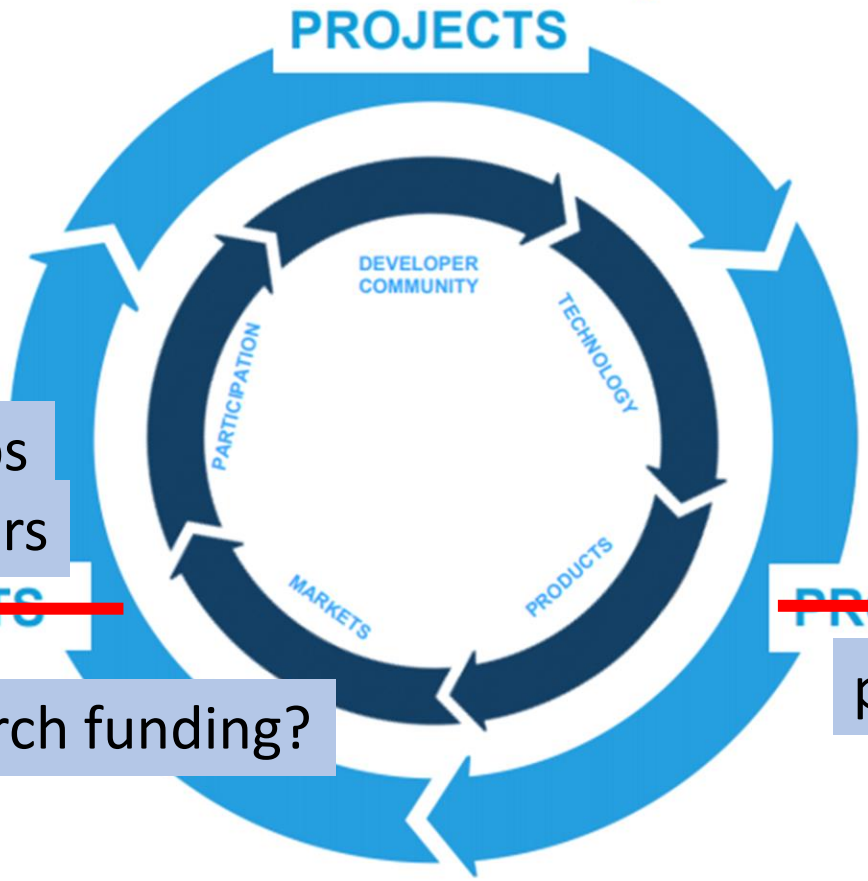
produce papers for groups

papers

~~PROFITS~~

students

Research funding?



~~PRODUCTS~~

papers

THE LINUX FOUNDATION

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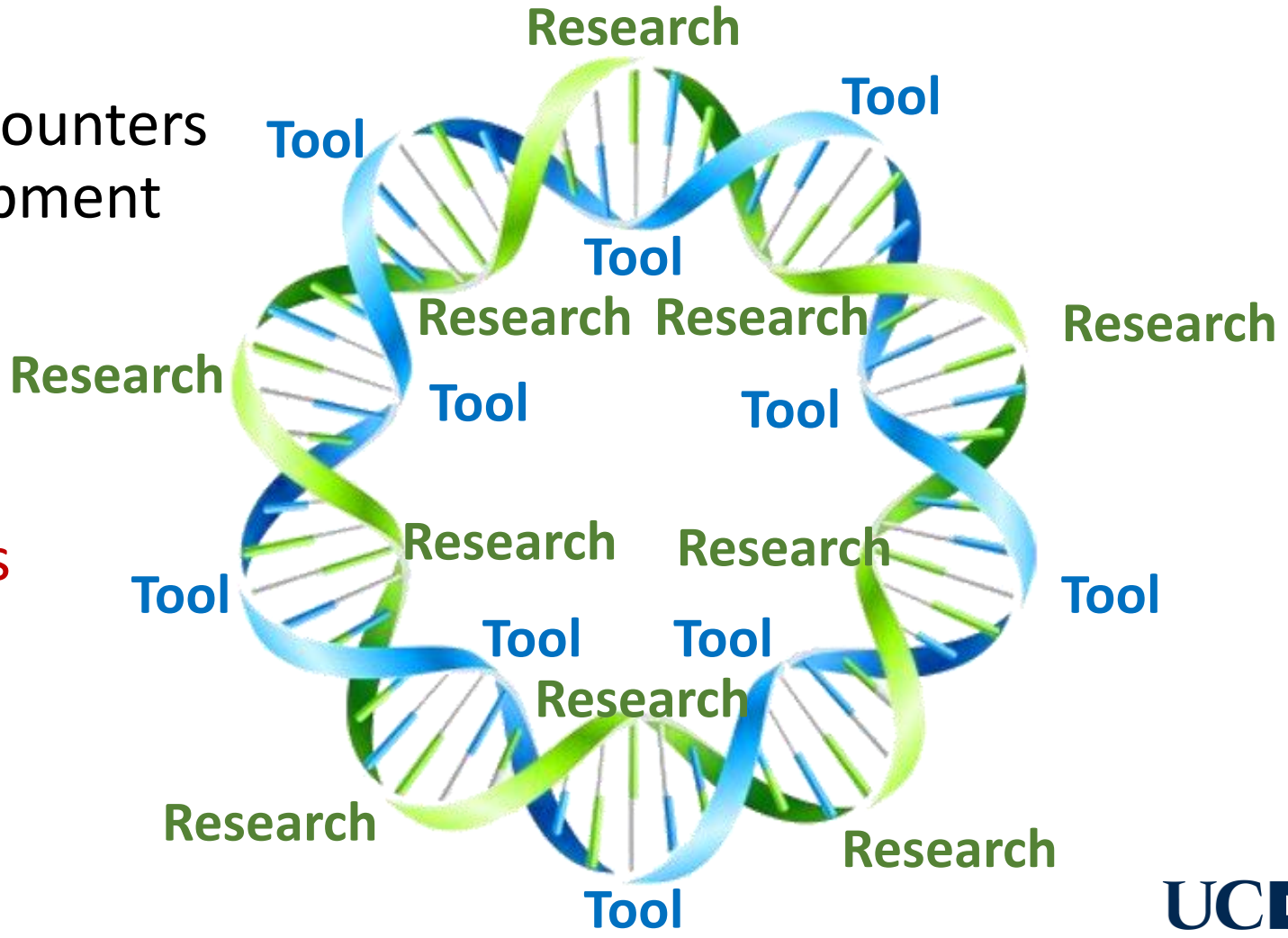
Intertwine tools and research

- What if the tool development leads to research? and vice-versa
- Satisfy the bean counters with agile development
- **Really** hard with current incentives



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Back down to Earth

- Is your tool the next LLVM?
  - Probably not
  - But wouldn't that be cool?!?!
- Develop like it is *the next big thing*

This will help you in your research,
help the community's research,
help scientific progress,
and *increase the **impact*** of your tool

we can all GREAT

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Common arguments for bad tools

- I might be embarrassed
  - It's "research quality"...
  - Some one might find a bug
  - What if my research is invalidated???
- Company will expose IP
  - Then why are you publishing?
- Faster to develop a bad tool
  - True, but what about a few years from now?