Project 2

- Example “feature themes”
  - I want to mark questions as resolved,
  - Allow instructors to endorse posts
  - Mark as duplicate
  - Search for topics
  - Tagging based on user type, predefined label, etc.
- Others
  - Auto-disappearing posts ☺
  - Poll posts

Software Archaeology and Anthropology

17-313 Fall 2023

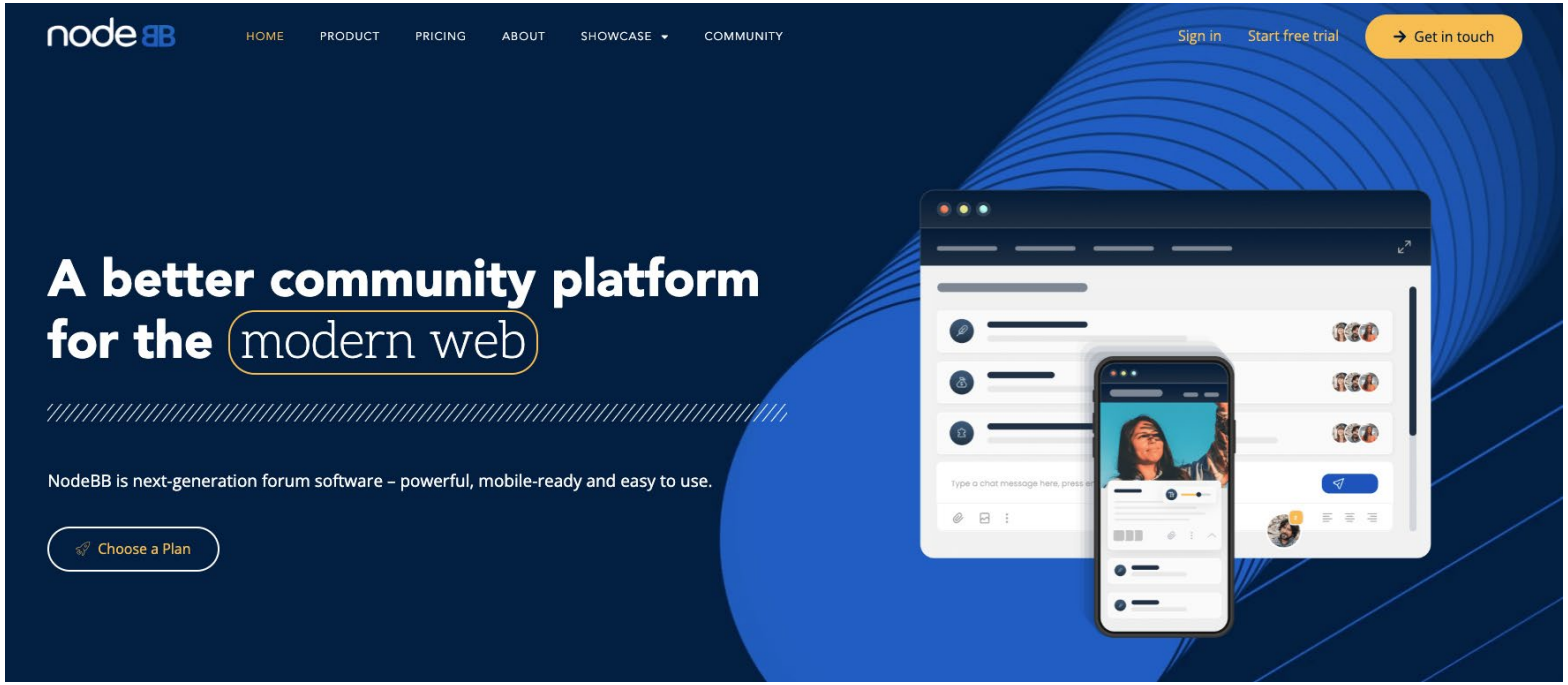
Foundations of Software Engineering

Learning Goals

- Understand and scope the task of taking on and understanding a new and complex piece of existing software
- Appreciate the importance of configuring an effective IDE
- Contrast different types of code execution environments including local, remote, application, and libraries
- Enumerate both static and dynamic strategies for understanding and modifying a new codebase

Context: big old pile of code

- … do something with it!



You will never understand the entire system!

Challenge: How do I tackle this codebase?

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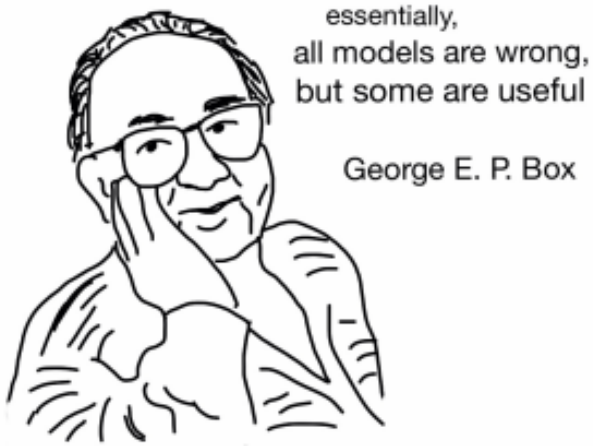
- Leverage your previous experiences (languages, technologies, patterns)
- Consult documentation, whitepapers
- Talk to experts, code owners
- Follow best practices to build a working model of the system

Today: How to tackle codebases

- Goal: develop and test a working model or set of working hypotheses about how (some part of) a system works
- Working model: an understanding of the pieces of the system (components), and the way they interact (connections)
- Focus: Observation, probes, and hypothesis testing
  - Helpful tools and techniques!



Live Demonstration: NodeBB

Steps to Understand a New Codebase

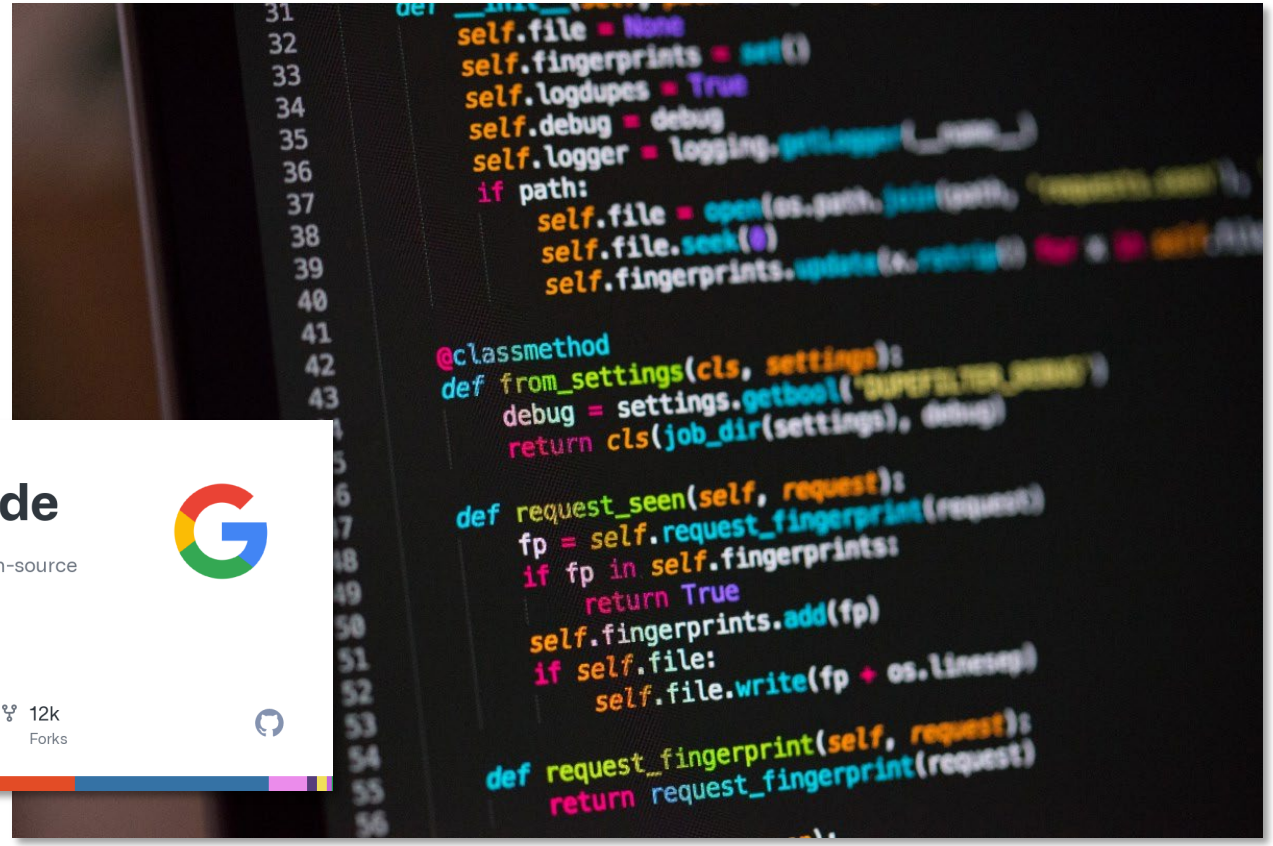
- Look at README.md
- Clone the repo.
- Build the codebase.
- Figure out how to make it run.
- What do you want to mess with?
  - Clone and own
- Traceability - Attach a debugger
  - View Source
  - Find the logs.
  - Search for constants (strings, colors, weird integers (#DEADBEEF))

Participation Activity

- Take out a piece of paper.
- Write down one pro and one con about trying to understand a new codebase by compiling and building it vs. just reading the code.
- Pair with your neighbor and discuss your answers. Do you agree?
- Share with the class!
- Submit it by the end of class.

Observation: Software is full of patterns

- File structure
- System architecture
- Code structure
- Names
- …



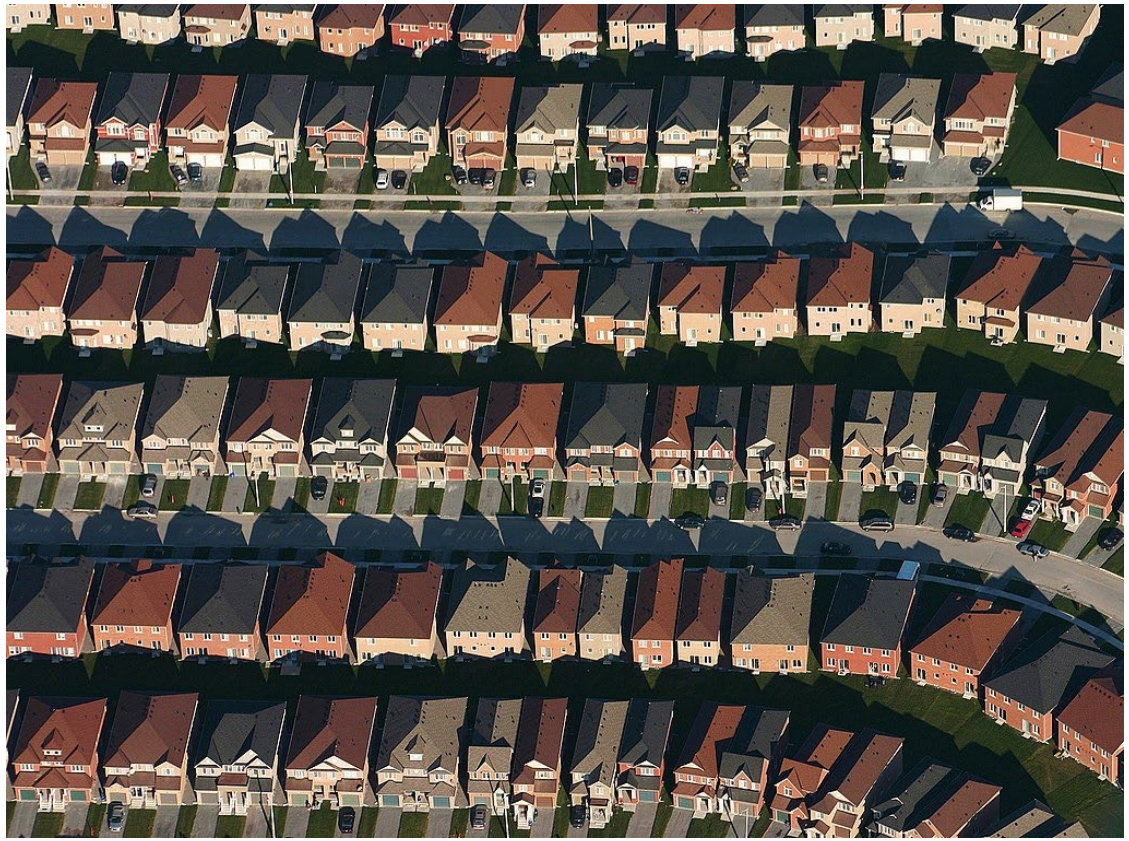
google/**styleguide**

Style guides for Google-originated open-source projects

73 Contributors · 1 Used by · 32k Stars · 12k Forks

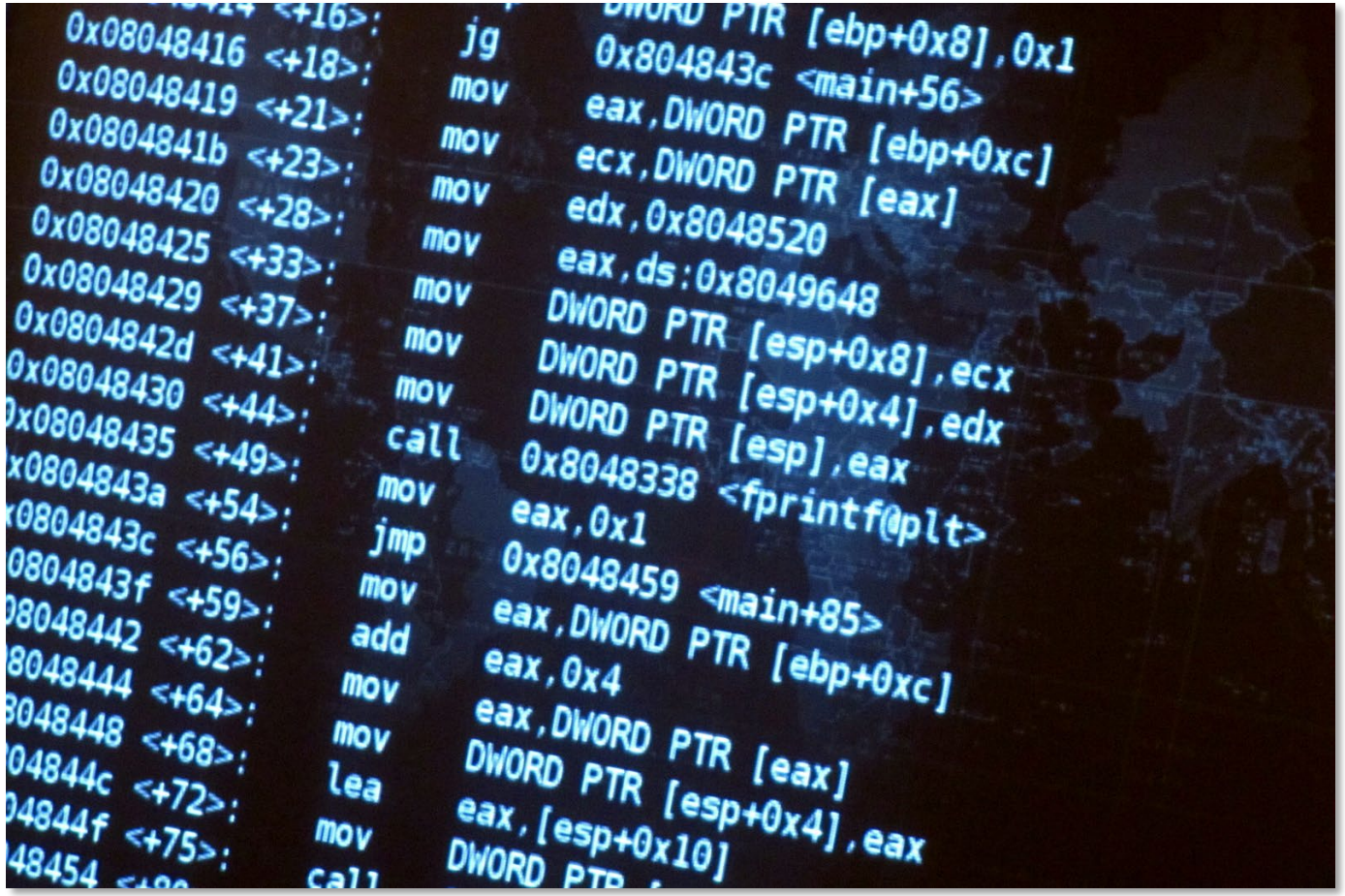
Observation: Software is massively redundant

- There's always something to copy/use as a starting point!



Observation: If code runs, it must have a beginning…

Observation: If code runs, it must exist…

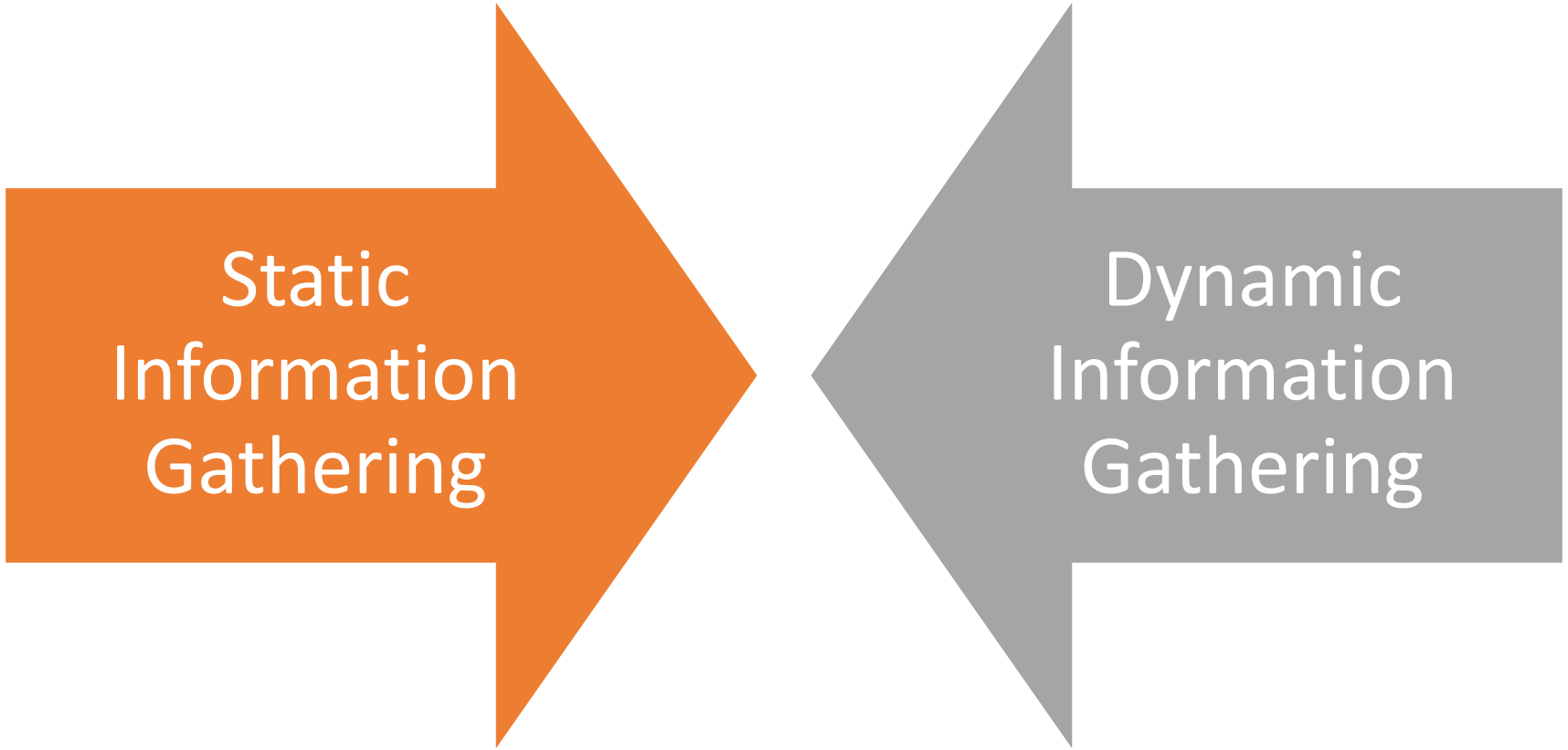


The Beginning: Entry Points

- Locally installed programs: run cmd, OS launch, I/O events, etc.
- Local applications in dev: build + run, test, deploy (e.g., docker)
- Web apps server-side: Browser sends HTTP request (GET/POST)
- Web apps client-side: Browser runs JavaScript, event handlers

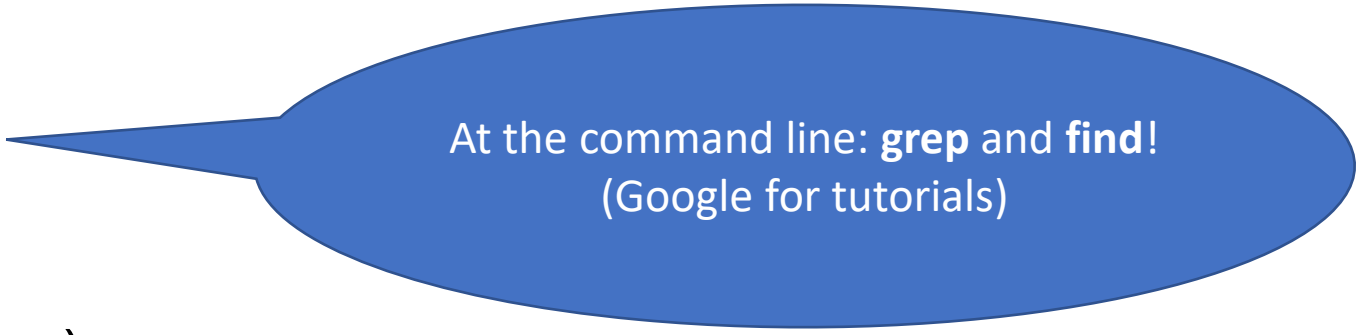
Creating a model of unfamiliar code

Source code built locally


Static
Information
Gathering
Dynamic
Information
Gathering

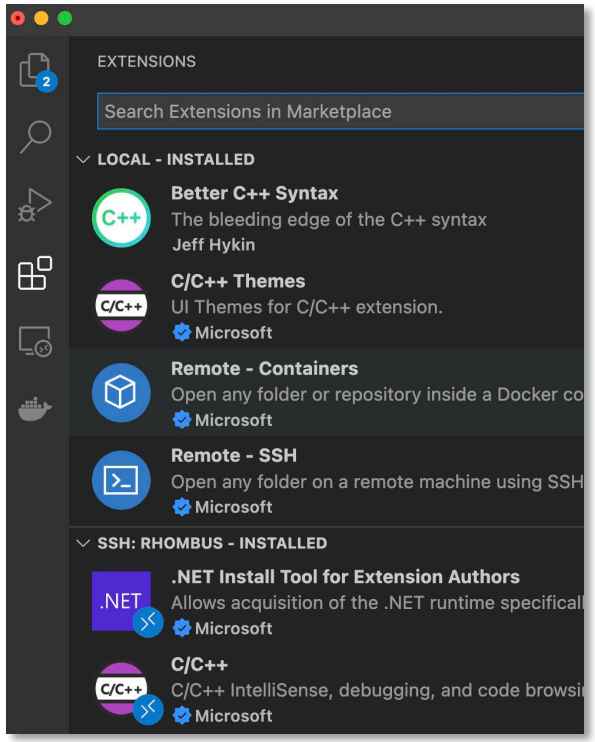
Static Information Gathering

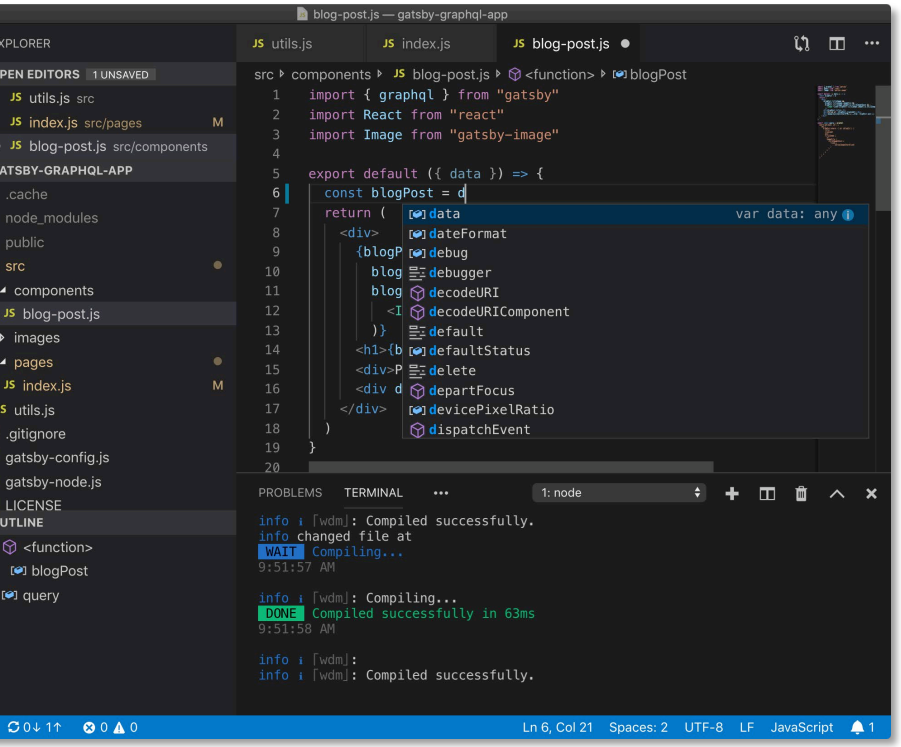
- Basic needs:
  - Code/file search and navigation
  - Code editing (probes)
  - Execution of code, tests
  - Observation of output (observation)



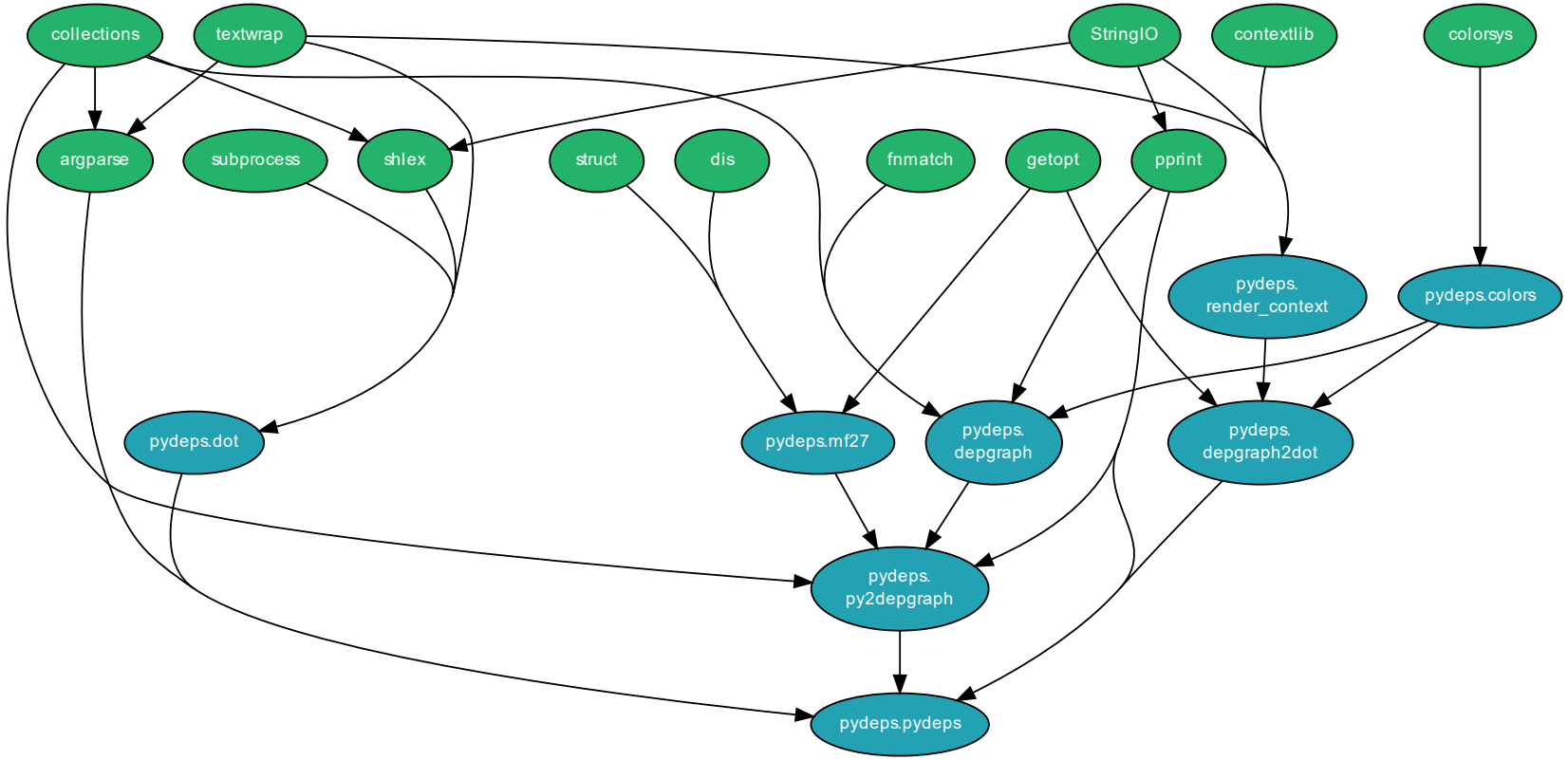
- Many choices here on tools! Depends on circumstance.
  - grep/find/etc. Knowing Unix tools is invaluable
  - A decent IDE
  - Debugger
  - Test frameworks + coverage reports
  - Google (or your favorite web search engine)
  - ChatGPT or LaMA

Static Information Gathering: Use an IDE!
Real software is too complex to keep in your head



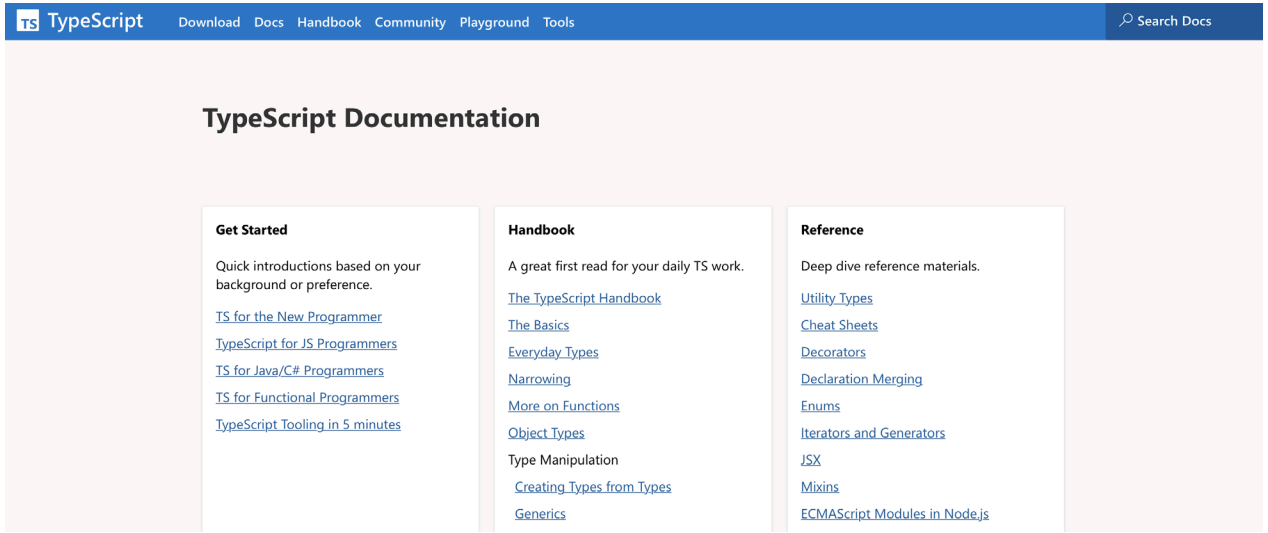


Dependency maps

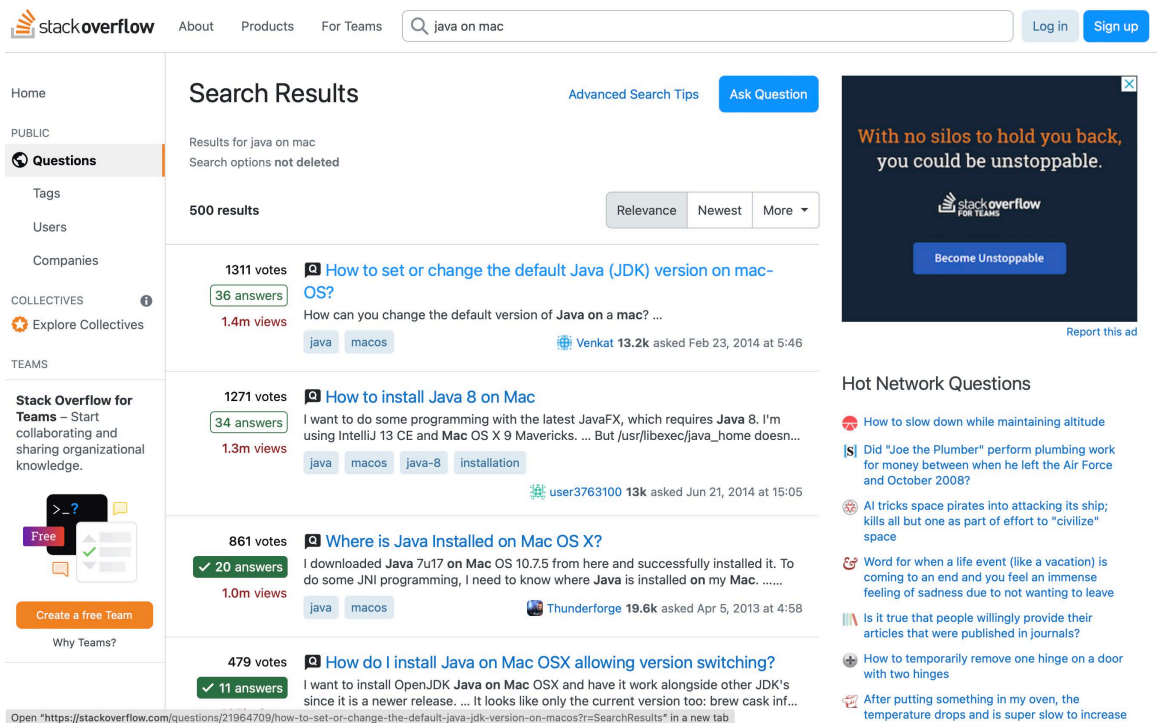


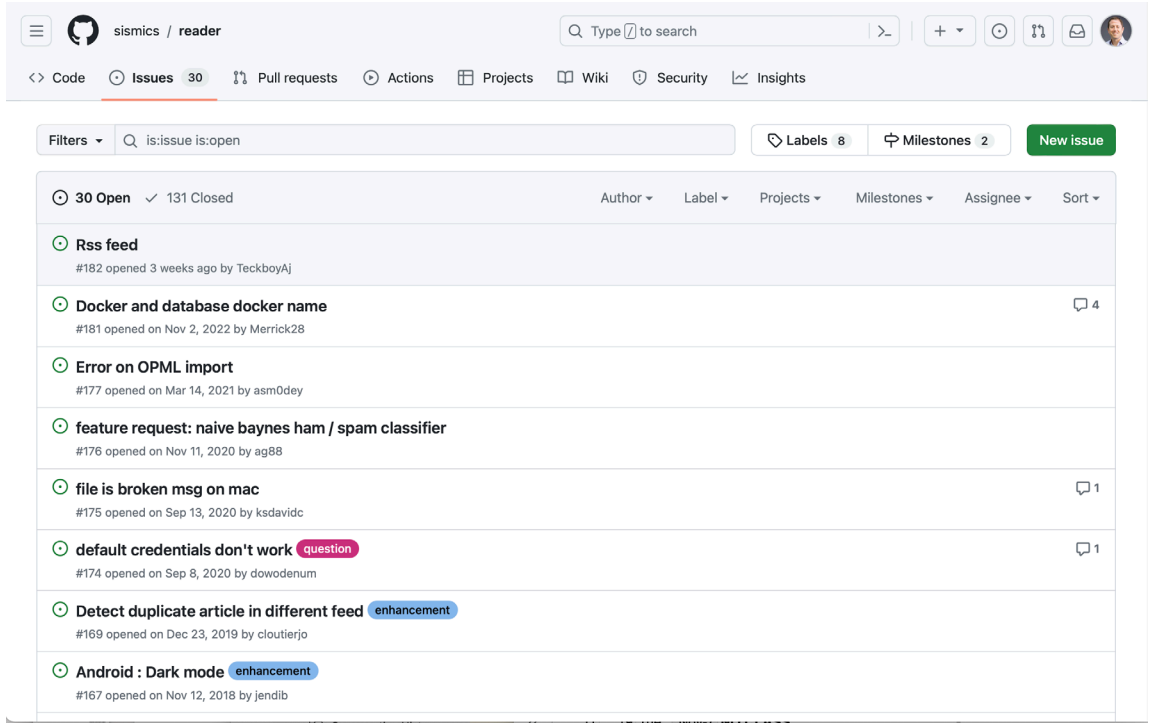
Consider documentation and tutorials judiciously

- Great for discovering entry points!
- Can teach you about general structure, architecture (more on this later in the semester)
- Often out of date.
- As you gain experience, you will recognize more of these, and you will immediately know something about how the program works
- Also: discussion boards; issue trackers



Discussion Boards and Issue Trackers





Dynamic Information Gathering

Change helps to inform and refine mental models

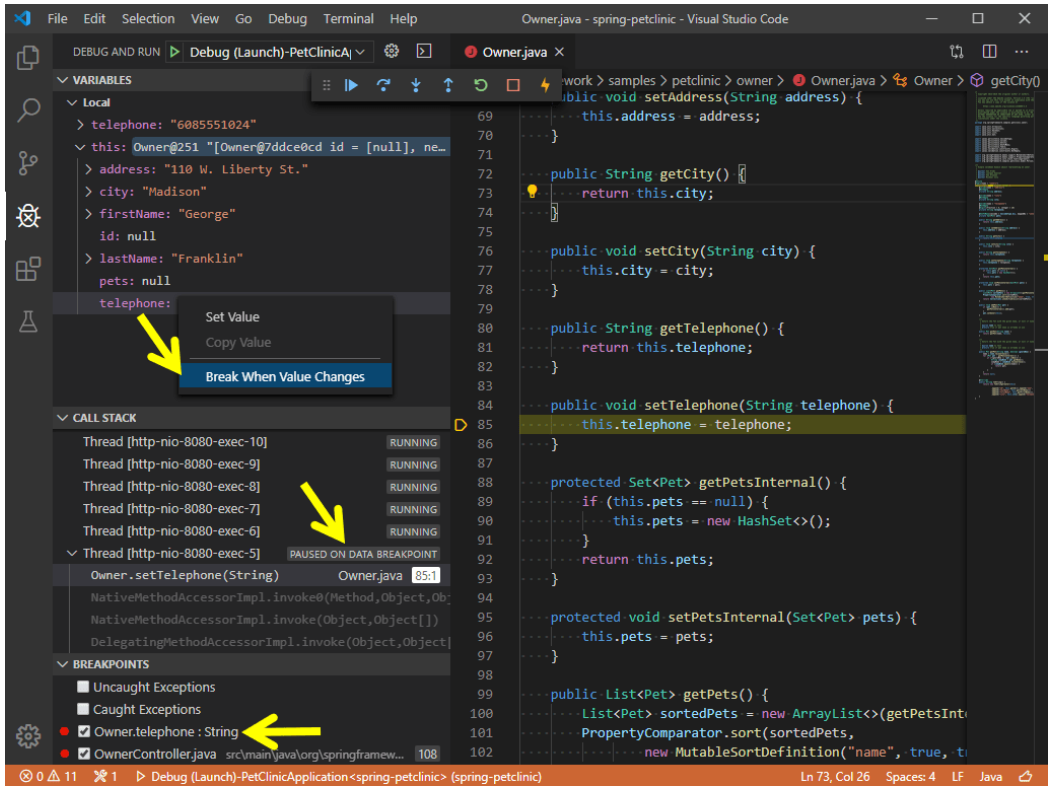
- Build it.
- Run it.
- Change it.
- Run it again.
- How did the behavior change?

How to start?

- Confirm that you can build and run the code.
  - Ideally both using the tests provided, and by hand.
- **Confirm that the code you are running is the code you built!**
- Confirm that you can make an externally visible change
- How? Where? Starting points:
  - Run an existing test, change it
  - Write a new test
  - Change the code, write or rerun a test that should notice the change
- Ask someone for help

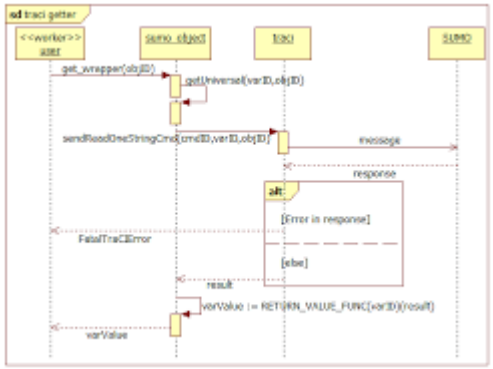
Probes: Observe, control or “lightly” manipulate execution

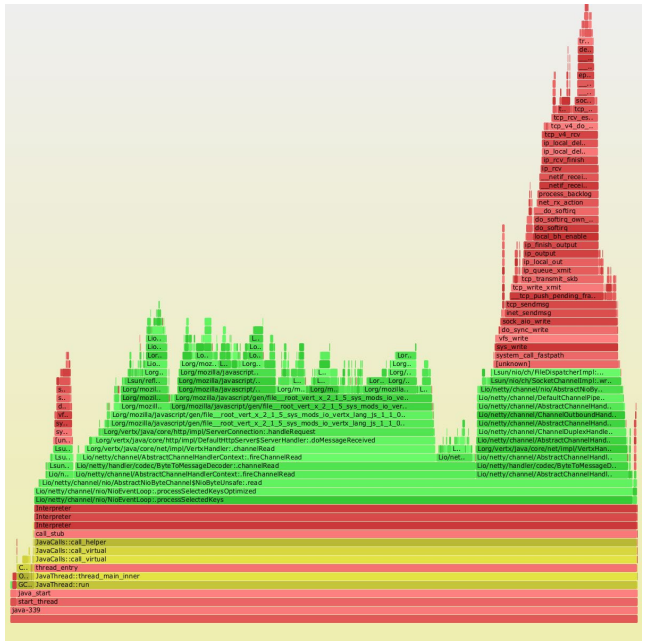
- print(“this code is running!”)
- Structured logging
- Debuggers
  - Breakpoint, eval, step through / step over
  - (Some tools even support remote debugging)
- Delete debugging
- Chrome Developer Tools



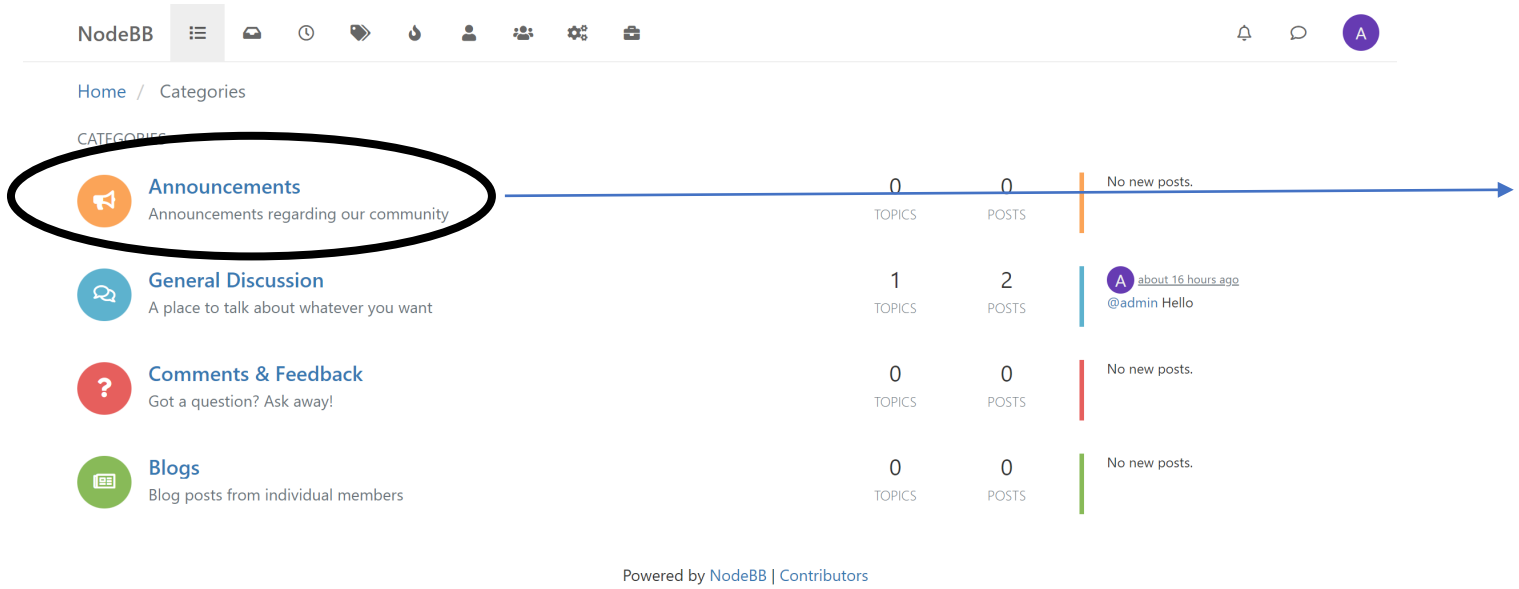
Runtime code analysis tools

- Collect runtime traces and visualize them
  - Flame graphs
  - Sequence diagrams
- Use judiciously





Tip: Find a particular thing and trace the action backward



E.g.,
Where do categories come from?
How are they stored?
How are they rendered?

Remember…

- Reading and understanding code is one of the most important skills you should learn
- It’s common to get stuck or feel overwhelmed. **Don’t give up!**
- You are lucky! There are many tools available today

Learning Goals

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Tip: Document and share your findings!

- Update README and docs
  - Or better: use a Developer Wiki
  - Use Mermaid for diagrams
- Collaborate with others
- Include negative results, too!