Free and Open-source Software

Martin Kellogg

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- Finish static analysis slides
- Reading Quiz
- History + the “free software” philosophy
- Open-source: licenses and business models
- Mid-semester survey: how am I doing?

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Announcements

- reminder: optional reading #1 due soon (Saturday night)
- we plan return all graded revised project plans by Friday evening

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    - of course not (Rice’s theorem again)
    - but, in practice, we can get very close

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    - security rules, etc.

Static analysis in practice

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heuristic is a fancy word for "best effort"

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  - aim for low false positive rates
  - widely used in industry:
    - ErrorProne at Google, Infer at Meta, SpotBugs at many places (including Amazon), Coverity, Fortify, etc.

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What is a pluggable type?

```
@Positive int x
```

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$$\texttt{@Positive}\ \underbrace{\texttt{int}}_{\text{Basetype}}\ \texttt{x}$$

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What is a pluggable type?

$$\underbrace{\texttt{@NonConstant}}_{\text{Type qualifier}}\ \underbrace{\texttt{int}}_{\text{Basetype}}\ \texttt{x}$$

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designing better (more expressive, more usable, etc.) pluggable type systems is an area of active research (mine!)

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  - you write a specification
  - tool verifies that code matches that specification
  - very high effort, but enables sound reasoning about complex properties (= worth it for very high value systems)

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        - but these tools (e.g., Coq) are **much harder to use**
- soundness theorems also usually make some **assumptions** about the code being analyzed (e.g., no calls to native code, no reflection)

Static analysis: summary

- static analysis is very good at enforcing **simple rules**
  - **much** better than humans at this
- all interesting semantic properties of programs are **undecidable**, so all static analyses must **approximate**
  - goal in analysis design is to **abstract away unimportant details**, but keep important details
  - **dataflow analysis** is one technique for static analysis
  - trade-offs between false positives, false negatives, analysis time
- soundness & completeness are **possible, but rare**
  - all soundness guarantees come with caveats about the TCB

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Reading quiz: free and open-source software

Q1: The author claims that the term “open source software” means:

A. software you can get for zero price
B. software which gives the user certain freedoms
C. software whose source code you can look at
D. none of the above

Q2: The author claims that the term “free software” means:

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A. software you c
B. software which
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The official definition of open source software (... too long to include here) was derived indirectly from our criteria for free software. It is not the same; … However, the **obvious meaning** for … "open source software" is "You can look at the source code." Indeed, most people seem to **misunderstand** "open source software" that way.

Q2: The author claims that the term "free software" means:

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- “Free” vs “open-source” vs “closed-source”/”proprietary” is an important **philosophical debate** within the larger software engineering community
- This debate has **consequences** for both how you build and how you use software that, as a software engineer, you should understand

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- Part of being a **software engineer** (vs just a programmer) is understanding the context of your work
- "Free" vs "open-source" vs "closed-source"/"proprietary" is an important **philosophical debate** within the larger software engineering community
- This debate has **consequences** for both how you build and how you use software that, as a software engineer, you should understand
  - plus, it's the sort of thing that other, more senior engineers will expect you to have an **informed opinion** about

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- I’ll abbreviate “open source software” as **OSS**

The Case against Open Source

WHEN YOU PROGRAM OPEN SOURCE,
YOU'RE PROGRAMMING
COMMUNISM
A REMINDER
from
YOUR FRIENDS AT MICROSOFT

[Variation of popular meme, original source unknown]

The Case against Open Source

- “Open-Source Doomsday”: Once all software is free, we’ll stop making more software and have a market collapse
- Innovation will be stifled by the risk that software will be copied
- Making source code public means easier to attack
- “Anarchistic” licensing prevents companies from profiting from open source software

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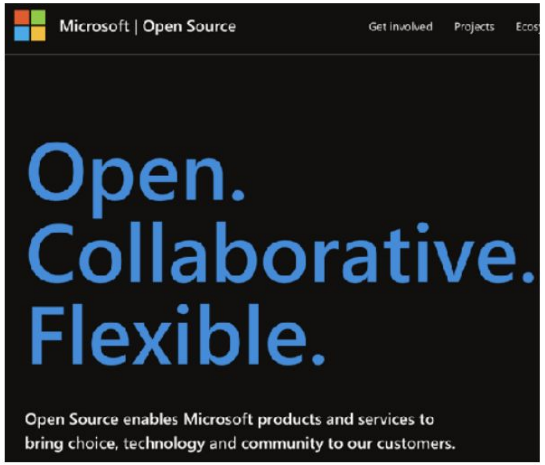
The Case for Open Source


Microsoft | Open Source

Get involved Projects Ecos

Open. Collaborative. Flexible.

Open Source enables Microsoft products and services to bring choice, technology and community to our customers.

[Screenshot, 2022, opensource.microsoft.com]

The Case for Open Source

- Many eyes make all bugs shallow
- End-users can improve and customize software to their needs
- New features can be proposed and developed organically
- Greater productivity when more code is reused (easier with open source)
  - i.e., DRY on an industry-wide scale

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        - Bell Labs practically gave it away to universities

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- Also 1983: “Starting this Thanksgiving I am going to write a complete Unix-compatible software system called GNU (Gnu’s Not Unix), and give it away free to everyone who can use it”

GNU logo (a gnu wildebeest)

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"Free as in speech, not as in beer"

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Difference between GPL v2 and GPL v3: is tivoization banned?

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- Popular alternative: "Do whatever you want with this software, but don't blame me if it doesn't work" ("***freeware***")

History: GNU/Linux (1991-Today)

- Stallman (FSF founder) set out to build an operating system in 1983, ended up building a **tremendous set of utilities** (“**GNU coreutils**”) that are needed by an OS (compiler, utilities, etc)

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Remember: 1983 = Unix licensing changed because of AT&T breakup

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- Rise of the internet, demand for internet servers drives demand for cheap/free OS
- Companies began **adopting and supporting** Linux for enterprise customers: e.g., IBM committed over $1B; Red Hat and others

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  - Modularize + reuse components
  - Democratic organization

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  - Democratic organization

How did the bazaar model become dominant is OSS?

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- January 1998: Netscape becomes first (?) company to make **source code for proprietary product open** (Mozilla)

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    - “Open Source is a development methodology; free software is a social movement” - Richard Stallman, FSF founder

Free and Open-source Software

Today’s agenda:

- Finish static analysis slides
- Reading Quiz
- History + the “free software” philosophy
- **Open-source: licenses and business models**
- Mid-semester survey: how am I doing?

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- Community/ownership models:
  - Corporate owner, community outreach (MySQL, MongoDB)
  - Foundation owner, corporate sponsors (GNU, Linux)

Is Open Source a Good Business Model?

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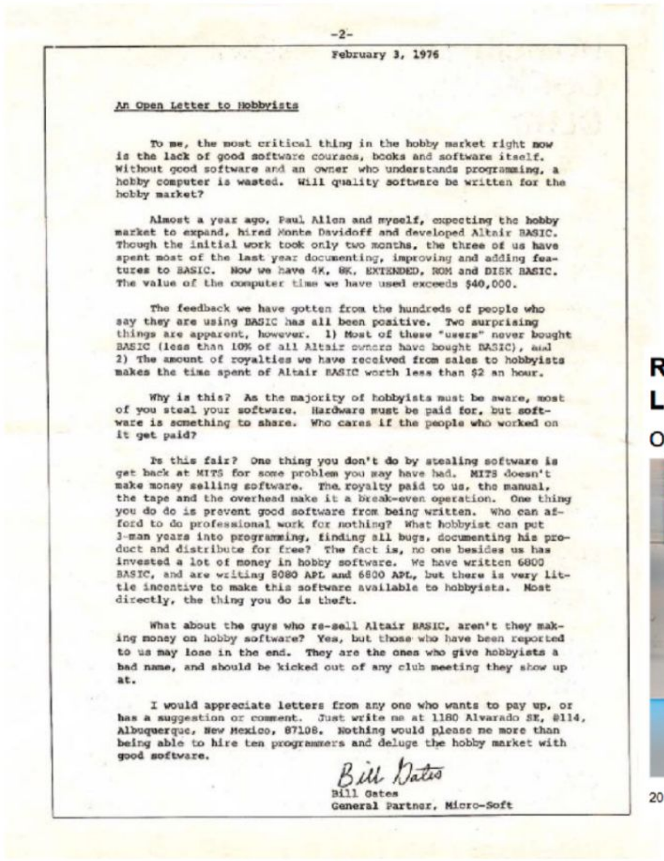

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February 3, 1976

<u>An Open Letter to Hobbyists</u>

To me, the most critical thing in the hobby market right now is the lack of good software courses, books and software itself. Without good software and an owner who understands programming, a hobby computer is wasted. Will quality software be written for the hobby market?

Almost a year ago, Paul Allen and myself, expecting the hobby market to expand, hired Monte Davidoff and developed Altair BASIC. Though the initial work took only two months, the three of us have spent most of the last year documenting, improving and adding features to BASIC. Now we have 4K, 8K, EXTENDED, ROM and DISK BASIC. The value of the computer time we have used exceeds $40,000.

The feedback we have gotten from the hundreds of people who say they are using BASIC has all been positive. Two surprising things are apparent, however. 1) Most of these "users" never bought BASIC (less than 10% of all Altair owners have bought BASIC), and 2) The amount of royalties we have received from sales to hobbyists makes the time spent of Altair BASIC worth less than $2 an hour.

Why is this? As the majority of hobbyists must be aware, most of you steal your software. Hardware must be paid for, but software is something to share. Who cares if the people who worked on it get paid?

Is this fair? One thing you don't do by stealing software is get back at MITS for some problem you may have had. MITS doesn't make money selling software. The royalty paid to us, the manual, the tape and the overhead make it a break-even operation. One thing you do do is prevent good software from being written. Who can afford to do professional work for nothing? What hobbyist can put 3-man years into programming, finding all bugs, documenting his product and distribute for free? The fact is, no one besides us has invested a lot of money in hobby software. We have written 6800 BASIC, and are writing 8080 APL and 6800 APL, but there is very little incentive to make this software available to hobbyists. Most directly, the thing you do is theft.

What about the guys who re-sell Altair BASIC, aren't they making money on hobby software? Yes, but those who have been reported to us may lose in the end. They are the ones who give hobbyists a bad name, and should be kicked out of any club meeting they show up at.

I would appreciate letters from any one who wants to pay up, or has a suggestion or comment. Just write me at 1180 Alvarado SE, #114, Albuquerque, New Mexico, 87108. Nothing would please me more than being able to hire ten programmers and deluge the hobby market with good software.

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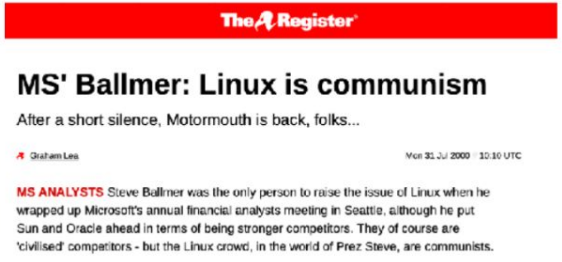

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Graham Lea — Mon 31 Jul 2000 // 10:10 UTC

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Give this article

A GitHub billboard being installed in San Francisco in 2014. Microsoft said on Monday that it would acquire the company for $7.5 billion. David Paul Morris/Bloomberg

By Steve Lohr

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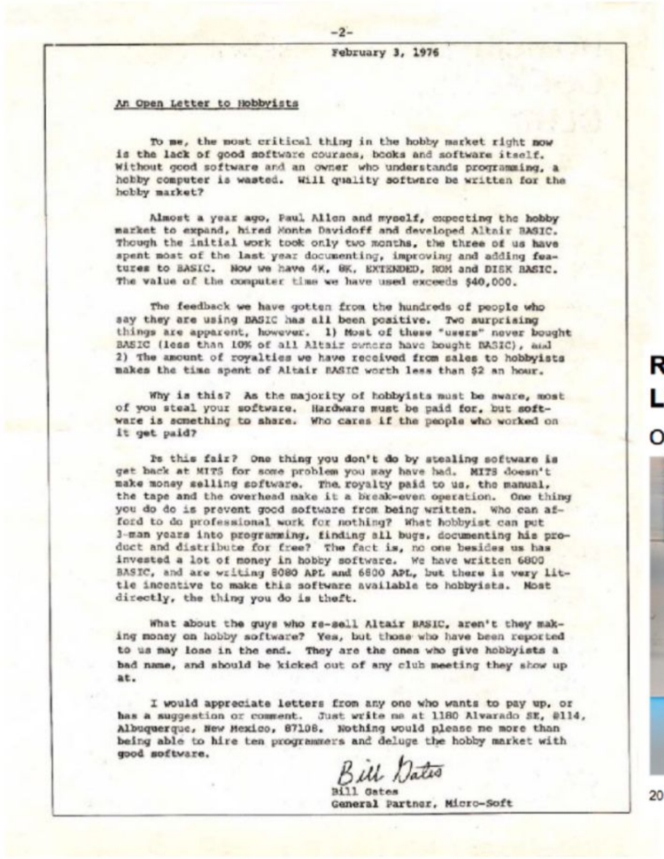

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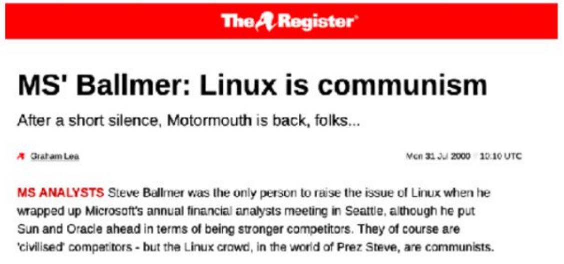

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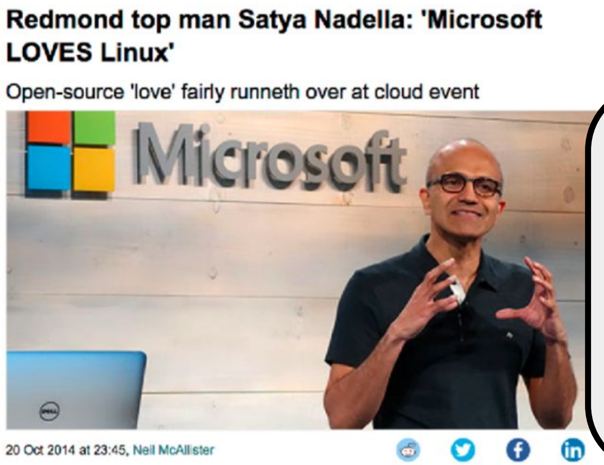

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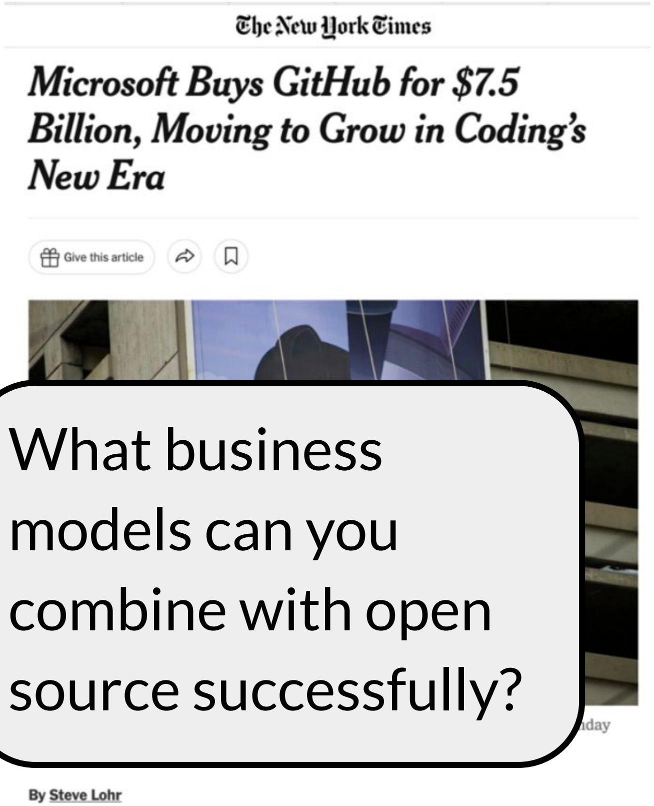

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nday

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What business models can you combine with open source successfully?

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- “**Open Core**” model: core component of a product is an open source utility; **premium plugins** available for a fee
- Example: Apache Kafka, a distributed message broker (glue in an event-based system)
  - Product is open source, maintained by Apache foundation, supported by company “Confluent”
  - Confluent provides plugins to connect Kafka to many different systems out-of-the-box

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  - many companies provide specialized “distributions” of these open source infrastructure and specialized tools to improve them; support the upstream project

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Philosophy: do we force participation, or try to grow/incentivize it in other ways?

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- Examples: MySQL, Qt

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- Oracle v Google: Oracle asserted that Java APIs were their property (copyright) and Google misused that; judge ruled that **APIs specifications cannot be copyrighted**

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    from public GitHub repositor
- Ongoing **legal battles** over:
  - Does training Codex on public code **violate copyleft** licenses?
  - Who is the **owner** of Copilot's output, especially when it is similar to public code that has an owner?

Many companies **forbid** their developers from using Copilot or similar tools because of the risks from these legal battles!

Takeaways: free and open-source software

- Free software and open-source software represent different **philosophies** about how code should be shared:
  - Free software: if I share with you, you need to share with me
  - Open source software: I share with you, you do what you want
- Because software is copyrightable, licenses enforce philosophy
  - **copyleft** licenses enforce free software principles
- Many viable open source business models, but all have risks
- **Licensing concerns** are the main reason to avoid open-source code in industry (industry loves permissive licenses)

Free and Open-source Software

Today's agenda:

- Finish static analysis slides
- Reading Quiz
- History + the "free software" philosophy
- Open-source: licenses and business models
- **Mid-semester survey: how am I doing?**

Mid-semester survey: anonymous

https://tinyurl.com/3r9j873j