INFM 603: Information Technology and Organizational Context

Session 13: Developing and Managing Technology

Jimmy Lin
The iSchool
University of Maryland

Wednesday, April 30, 2014

The Technology Lifecycle

- How do you know what to build?
- How do you actually build it?
- How do you keep it running?

It's about asking the right questions!

First Things First

- What's already there?
- Do users actually want it?
- Is technology even the right answer?
- What's the use context?

Technology is for solving problems!

How do you know what to build?

- Ask your users
- Watch them

So you're going to build technology…

Major Decisions

- Build vs. buy
- In-house vs. out-source
- Open source vs. proprietary
- Best of breed vs. integrated solution

Architecture Choices

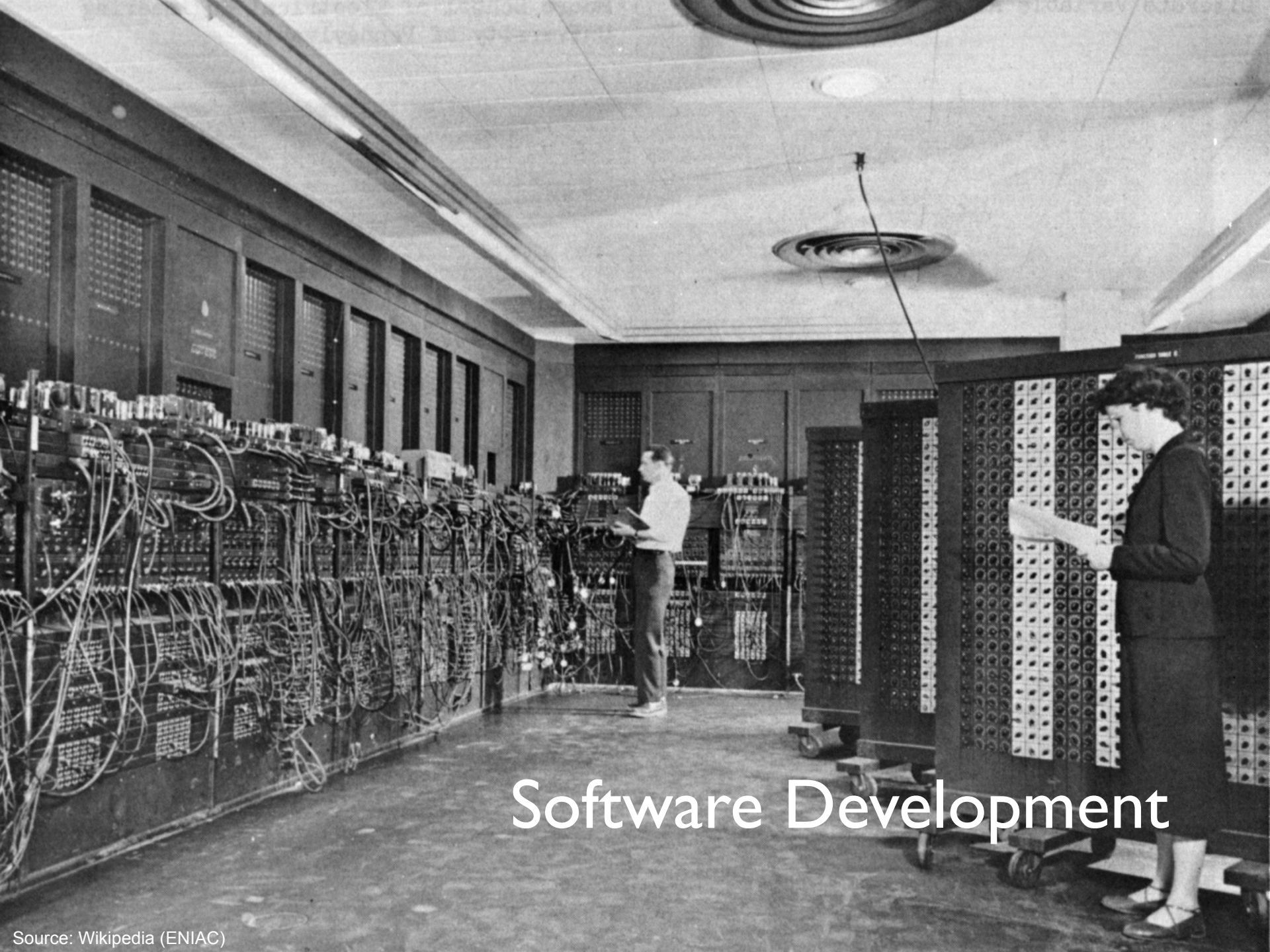
- Desktop software
- Web app
  - Hosted in the cloud?
  - In-house datacenter?
- Mobile app

Advantages and disadvantages to each!

Requirements

- Functionality
- Latency and throughput
- Capacity
- Reliability and resiliency
- Flexibility
- Development cost and time

There's no free meal!



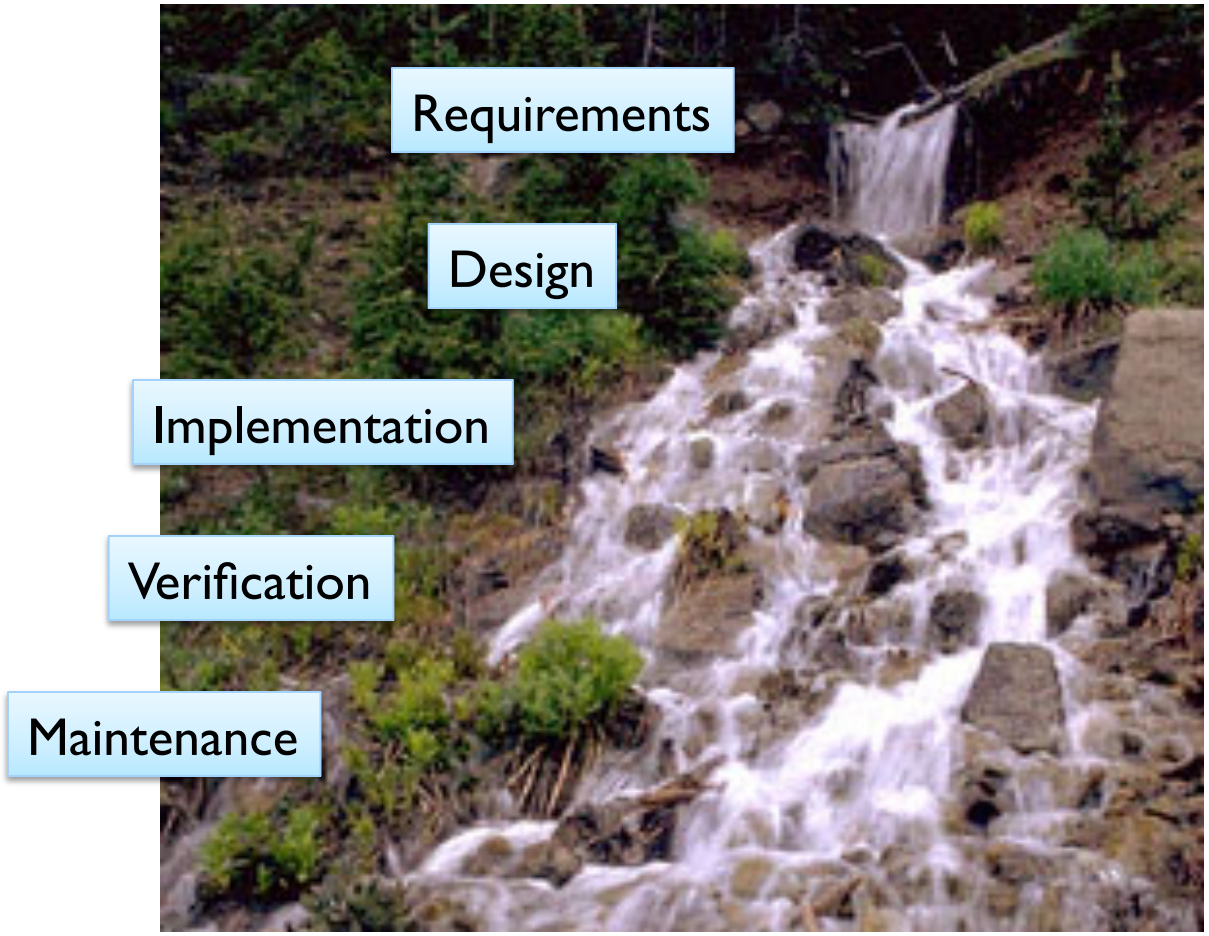
Software Development

Source: Wikipedia (ENIAC)

The Waterfall Model

- Key idea: upfront investment in *design*
  - An hour of design can save a week of debugging!
- Five stages:
  - Requirements: figure out what the software is supposed to do
  - Design: figure out how the software will accomplish the tasks
  - Implementation: actually build the software
  - Verification: makes sure that it works
  - Maintenance: makes sure that it keeps working

The Waterfall Model

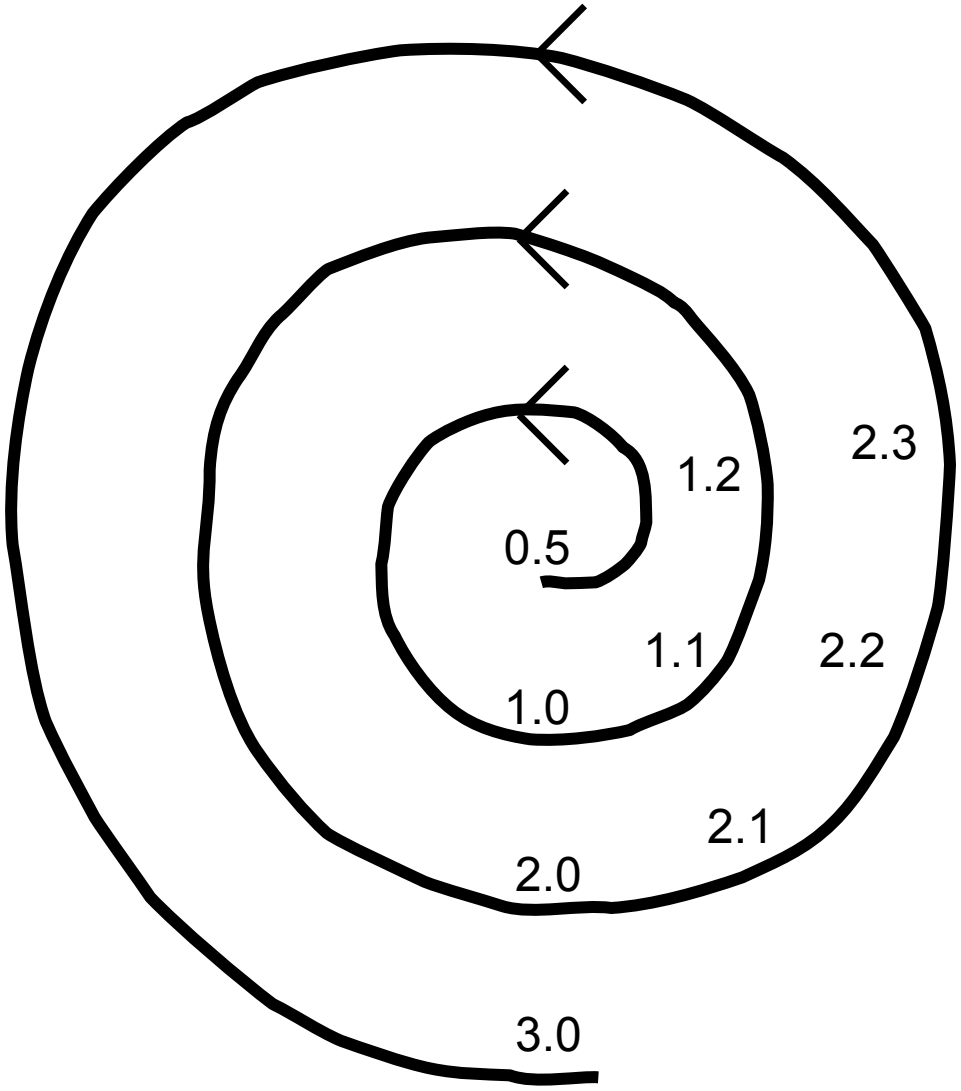



KEEP CLEAR
KEEP CLEAR

The Spiral Model

- Build what you think you need
  - Perhaps using the waterfall model
- Get a few users to help you debug it
  - First an “alpha” release, then a “beta” release
- Release it as a product (version 1.0)
  - Make small changes as needed (1.1, 1.2, ….)
- Save big changes for a major new release
  - Often based on a total redesign (2.0, 3.0, …)

The Spiral Model



Unpleasant Realities

- The waterfall model doesn't work well
  - Requirements usually incomplete or incorrect
- The spiral model is expensive
  - Redesign leads to wasted effort

Prototyping

- What's the purpose of the prototype?
  - Meant to explore requirements, then be thrown away
  - An initial version of the software to be subsequently refined
- Both are fine, as long as the goal is clear
- Be aware, interfaces can be deceiving

SCRUM

- An agile development methodology: the “fashion” today
- As with any methodology…
  - Don’t blindly follow processes
  - Understand the rationale behind them
  - Adapt them to your context

Key Concepts

- Roles:
  - Product owner: voice of the customer
  - Development team: small team software engineers
  - Scrum master: primary role as facilitator
- User stories: short *non-technical* description of desired user functionality
  - "As a user, I want to be able to search for customers by their first and last names"
  - "As a site administrator, I should be able to subscribe multiple people to the mailing list at once"

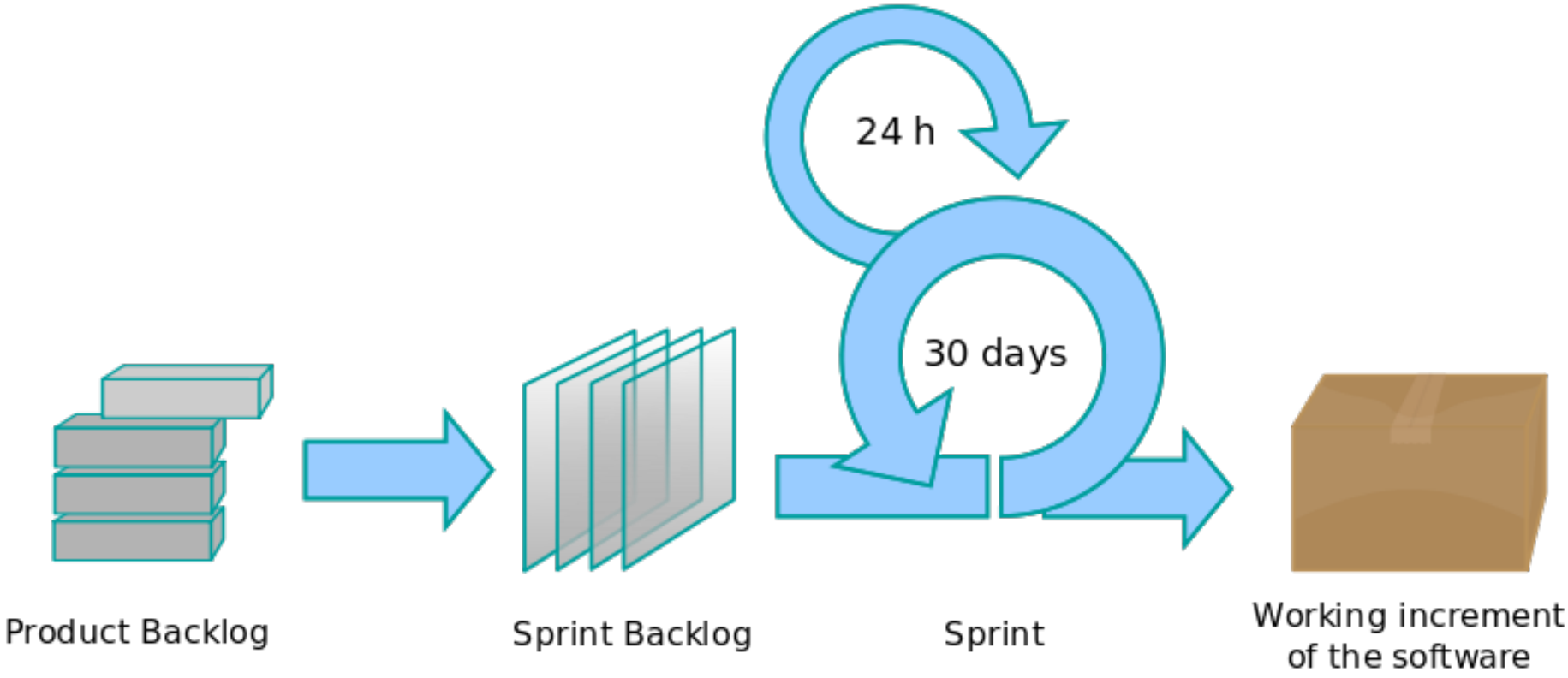
Basic SCRUM Cycle

- The sprint:
  - Basic unit of development
  - Fixed duration (typically one month)
  - End target is a working system (*not* a prototype)
- Sprint planning meeting
  - Discussion between product owner and development team on what can be accomplished in the sprint
  - Sprint goals are owned by the development team

Standup Meetings

- Short, periodic status meetings (often daily)
- Three questions:
  - What have you been working on (since the last standup)?
  - What are you planning to work on next?
  - Any blockers?

SCRUM


24 h
30 days
Product Backlog
Sprint Backlog
Sprint
Working increment
of the software

Advantages of SCRUM

- Fundamentally iterative, recognizes that requirements change
- Development team in charge of the sprint backlog
  - Favors self-organization rather than top-down control
  - Reprioritize in response to changing requirements and progress
- Time-limited sprints ensure periodic delivery of new product increments
  - Allows opportunities to receive user feedback, change directions, etc.
- Buzzword = *velocity*

Disadvantages

- Can be chaotic
- Dependent on a good SCRUM master to reconcile priorities
- Requires dedication of team members
- Slicing by “user stories” isn’t always feasible


Keeping Technology Running

Management Issues

- Operating costs
  - Staff time
  - Physical resources (space, cooling, power) or the cloud
  - Periodic maintenance
  - Equipment replacement
- Retrospective conversion
  - Moving from “legacy systems”
  - Even converting electronic information is expensive!
- Incremental improvements
  - Upgrade path?

Management Issues

- Usage information
  - Usage logs, audit trails, etc.
  - Collection, storage, as well as analysis
- Training
  - Staff
  - Users
- Privacy, security, access control
- Backup and disaster recovery
  - Periodicity, storage location
  - The cloud doesn't necessarily solve all the issues

Remember Murphy's Law!

TCO

- "Total cost of ownership"
- Hardware and software aren't the only costs!
- Other (hidden) costs: all the issues discussed above

What is open source?

- Proprietary vs. open source software
- Open source used to be a crackpot idea:
  - Bill Gates on Linux (3/24/1999): “I don’t really think in the commercial market, we’ll see it in any significant way.”
  - MS 10-Q quarterly filing (1/31/2004): “The popularization of the open source movement continues to pose a significant challenge to the company’s business model”
- Open source…
  - For tree hugging hippies?
  - Make love, not war?

Basic Definitions

- What is a program?

  An organized list of instructions that, when executed, causes the computer to behave in a predetermined manner. Like a recipe.

- What is source code?

  Program instructions in their original, *human-readable* form.

- What is object/executable code (binaries)?

  Program instructions in a form that can be directly executed by a computer. A *compiler* takes source code and generates executable code.

Proprietary Software

- Distribution in machine-readable binaries only
- Payment for a license
  - Grants certain usage rights
  - Restrictions on copying, further distribution, modification
- Analogy: buying a car…
  - With the hood welded shut
  - That only you can drive
  - That you can't change the rims on

Open Source Principles

- Free distribution and redistribution
  - "Free as in speech, not as in beer"

    "The license may not restrict any party from selling or giving away the software as a component of an aggregate software distribution containing programs from several different sources. The license may not require royalty or other fee for such sale."
- Source code availability

  "The program must include source code, and must allow distribution in source code as well as compiled form".
- Provisions for derived works

  "The license must allow modifications and derived works, and must allow them to be distributed under the same terms as the license of the original software."

Open Source vs. Proprietary

- Who gets the idea to develop the software?
- Who actually develops the software?
- How much does it cost?
- Who can make changes?

Examples of Open Source Software

	Proprietary	Open Source
Operating system	Windows	Linux
Office suite	Microsoft Office	OpenOffice
Image editor	Photoshop	GIMP
Web browser	Internet Explorer	Mozilla
Web server	IIS	Apache
Database	Oracle	MySQL

Open Source: Pros

- Peer-reviewed code
- Dynamic community
- Iterative releases, rapid bug fixes
- Released by engineers, not marketing people
- No vendor lock-in
- Simplified licensed management

Pros in Detail

- Peer-reviewed code
  - Everyone gets to inspect the code
  - More eyes, fewer bugs
- Dynamic community
  - Community consists of coders, testers, debuggers, users, etc.
  - Any person can have multiple roles
  - Both volunteers and paid by companies
  - Volunteers are highly-motivated

Pros in Detail

- Iterative releases, rapid bug fixes
  - Anyone can fix bugs
  - Bugs rapidly fixed when found
  - Distribution of "patches"
- Released by engineers, not marketing people
  - Stable versions ready only when they really are ready
  - Not dictated by marketing deadlines

Pros in Detail

- No vendor lock-in
  - Lock in: dependence on a specific program from a specific vendor
  - Putting content in MS Word ties you to Microsoft forever
  - Open formats: can use a variety of systems
- Simplified licensed management
  - Can install any number of copies
  - No risk of illegal copies or license audits
  - No anti-piracy measures (e.g. CD keys, product activation)
  - No need to pay for perpetual upgrades
  - Doesn't eliminate software management, of course

Cons of Open Source

- Dead-end software
- Fragmentation
- Developed by engineers, often for engineers
- Community development model
- Inability to point fingers

Cons in Detail

- Dead-end software
  - Development depends on community dynamics: What happens when the community loses interest?
  - How is this different from the vendor dropping support for a product? At least the source code is available
- Fragmentation
  - Code might “fork” into multiple versions: incompatibilities develop
  - In practice, rarely happens

Cons in Detail

- Developed by engineers, often for engineers
  - My favorite "pet feature"
  - Engineers are not your typical users!
- Community development model
  - Cannot simply dictate the development process
  - Must build consensus and support within the community
- Inability to point fingers
  - Who do you call up and yell at when things go wrong?
  - Buy a support contract from a vendor!

Open Source Business Models

- Support Sellers

  Give away the software, but sell distribution, branding, and after-sale service.

- Loss Leader

  Give away the software as a loss-leader and market positioner for closed software.

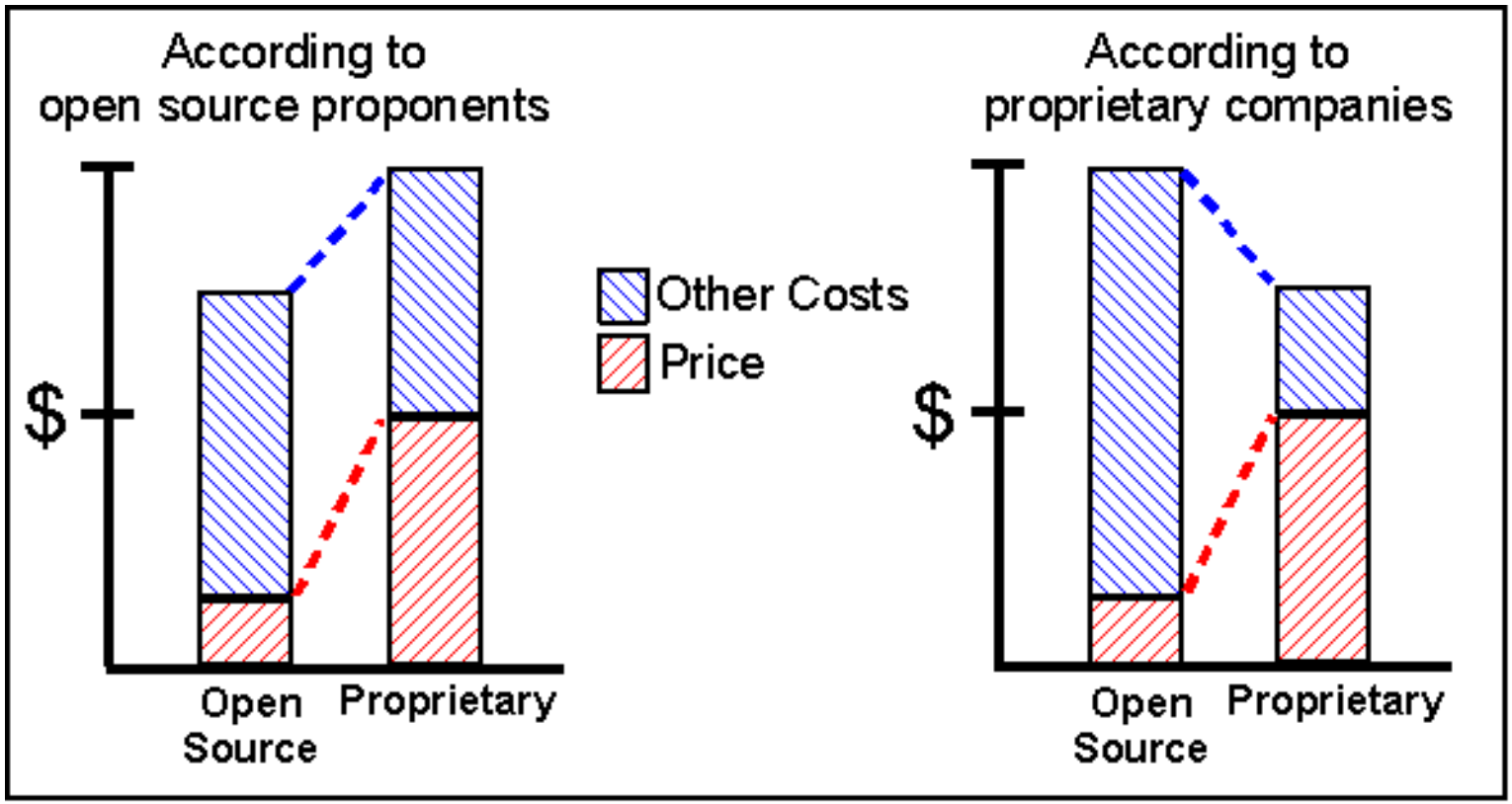
- Widget Frosting

  If you're in the hardware business, giving away software doesn't hurt you and has it's advantages. What are they?

- Accessorizing

  Sell accessories: books, compatible hardware, complete systems with open-source software pre-installed, and merchandise (open-source T-shirts, coffee mugs, Linux penguin dolls, etc.).

The TCO Debate



Is open source right for you?

- Depends

Questions?