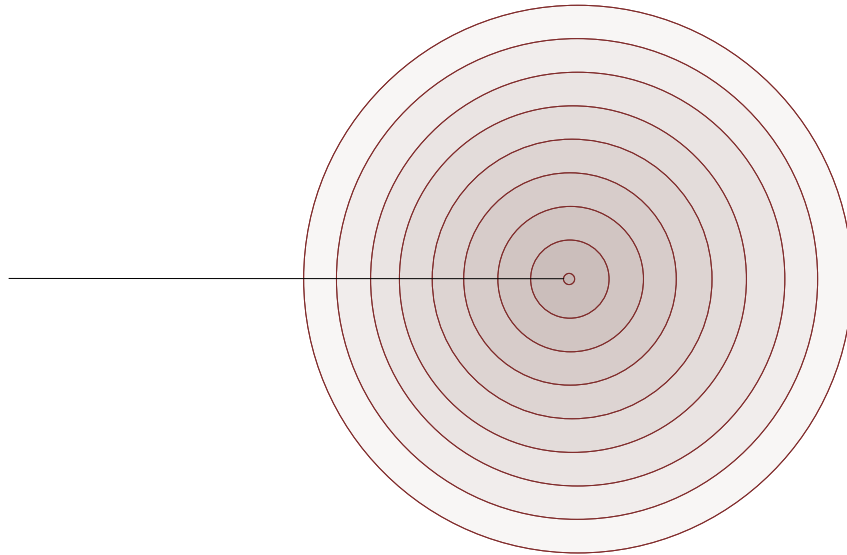


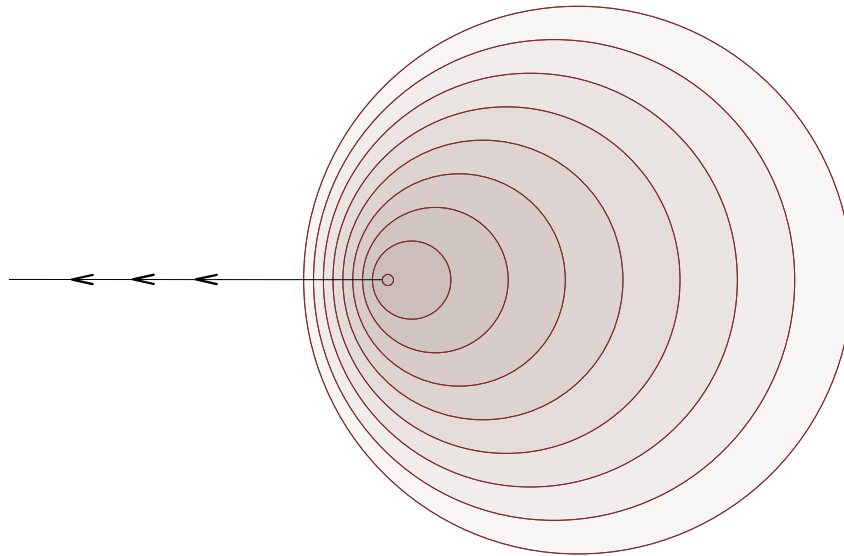
Open source influences on technology innovation

Allison Randal
University of Cambridge

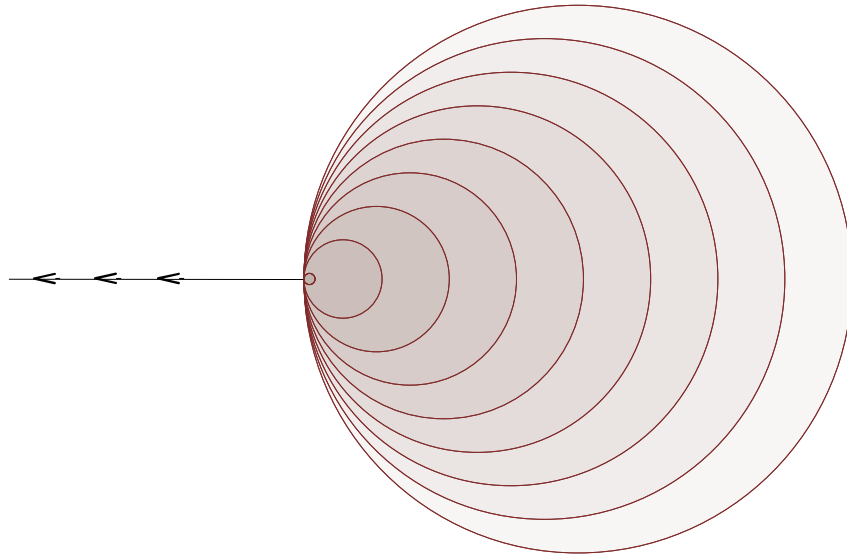
Speed of Sound



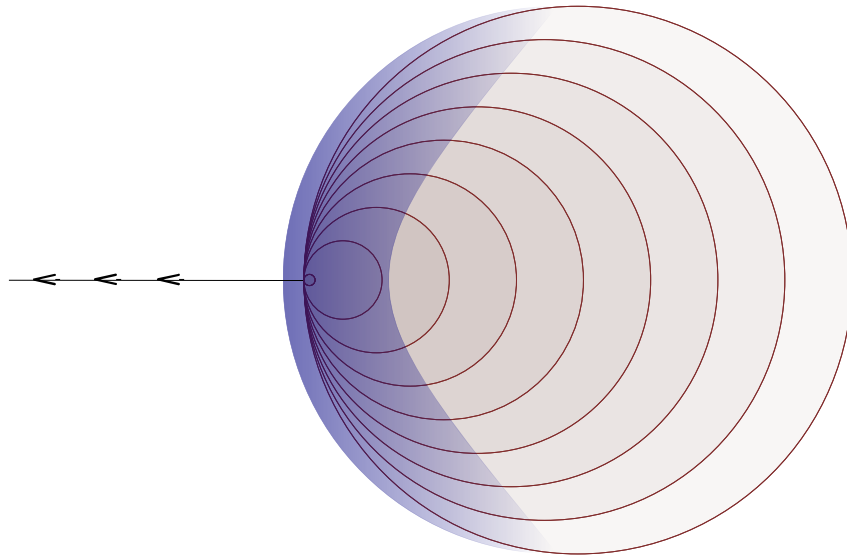
Subsonic Speeds



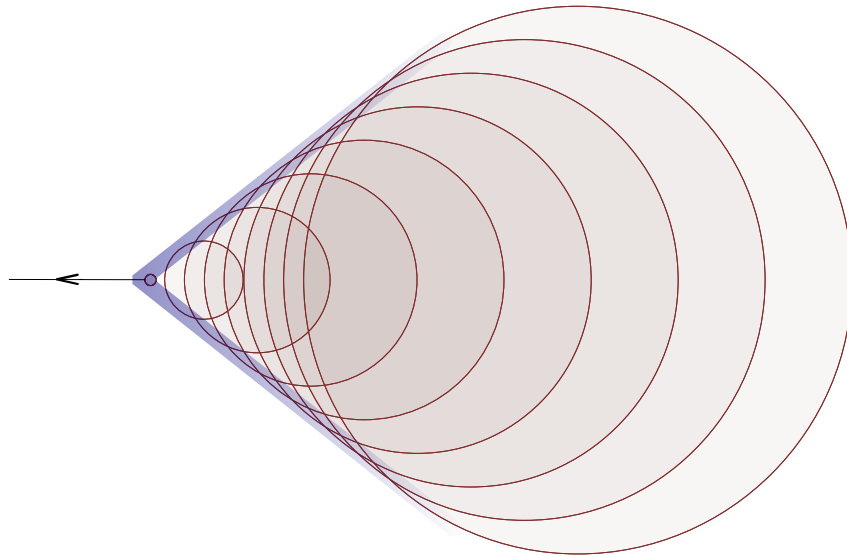
Sonic Speeds



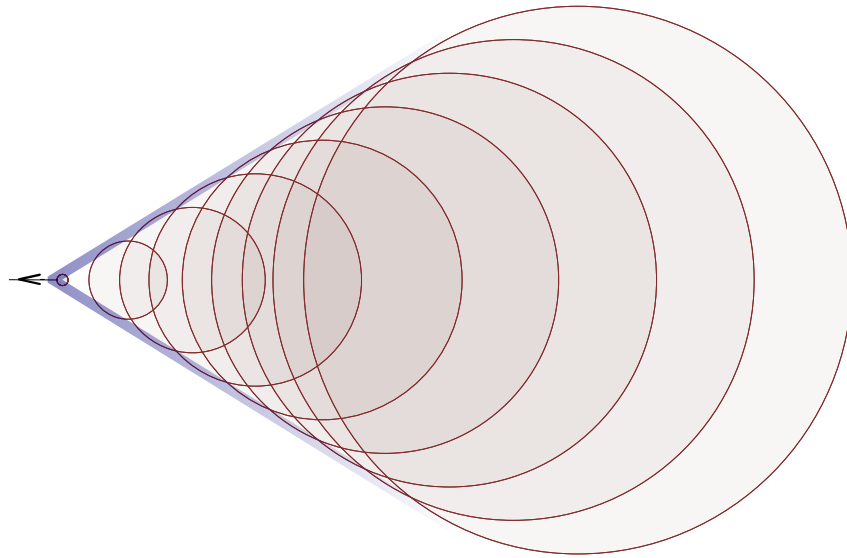
Sound Barrier



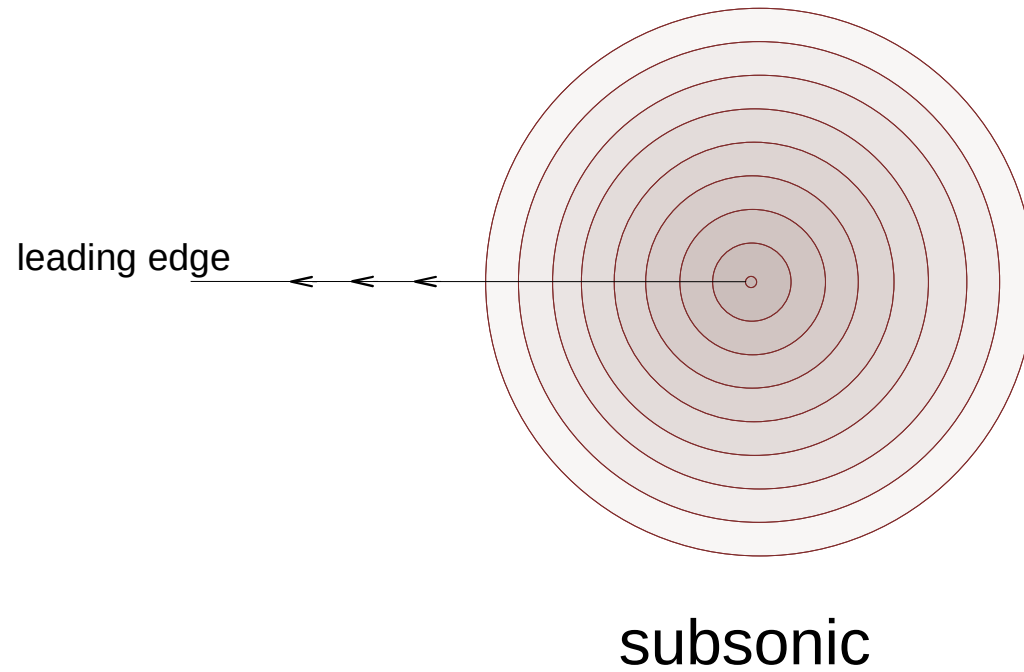
Supersonic Speeds



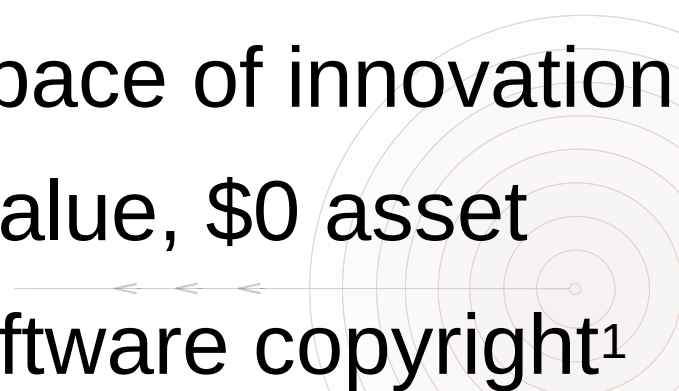
Supersonic Speeds



First Age of Software

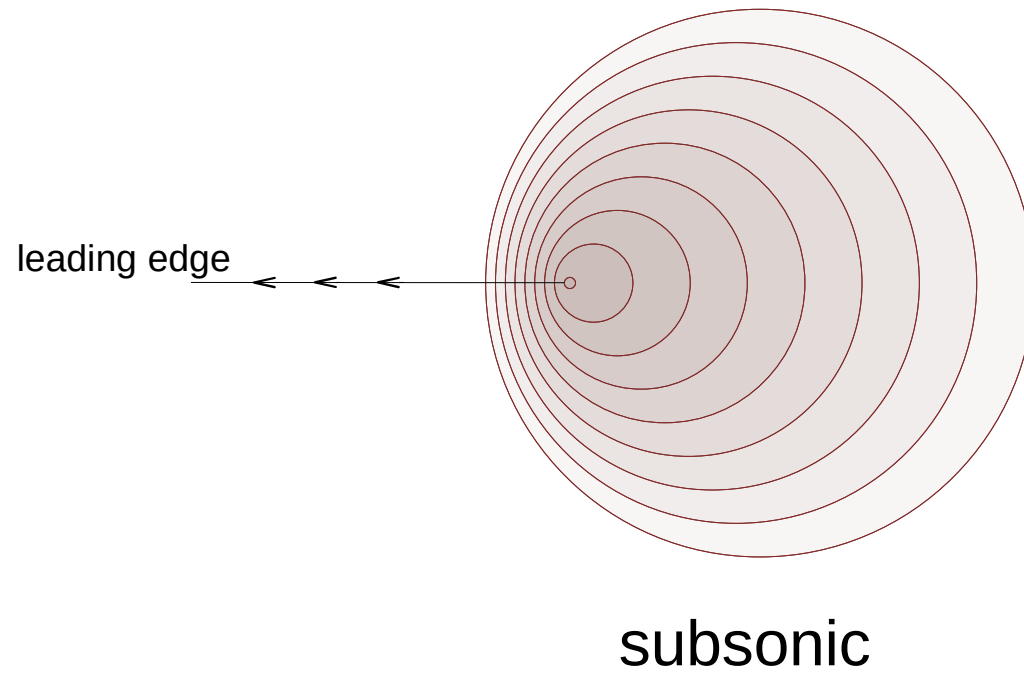


First Age of Software

- 1940s-1970s
 - Slow pace of innovation
 - Low value, \$0 asset
 - No software copyright¹
- 

¹Lemley, M., Menell, P., Merges, R., Samuelson, P. and Carver, B. (2011) *Software and Internet Law*, 4th edition, Wolters Kluwer. (pp. 31-32)

First Age of Software



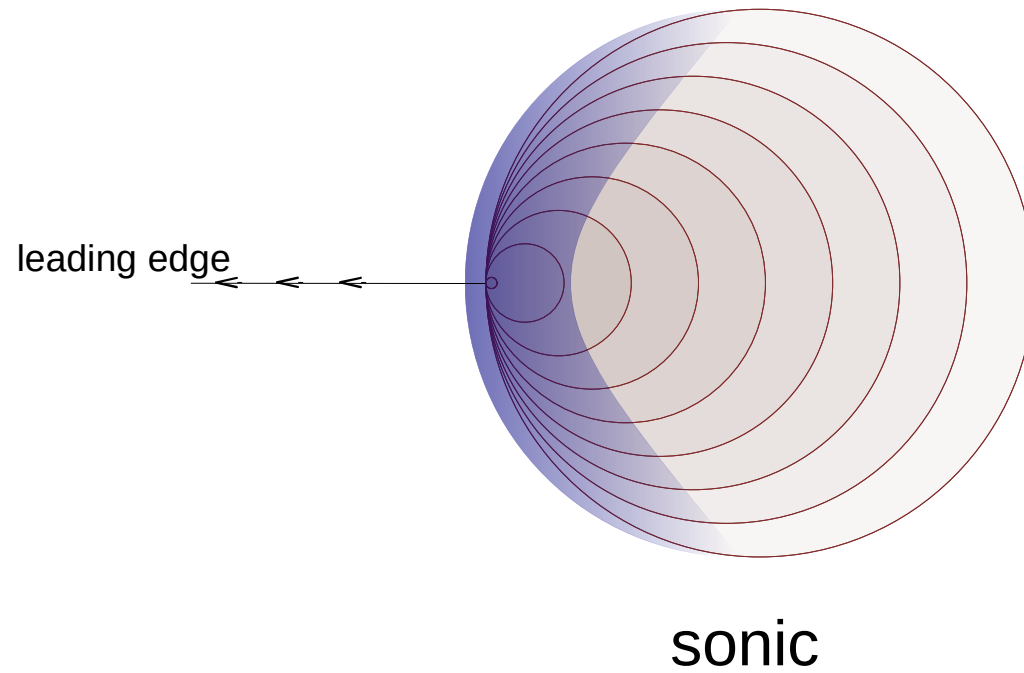
First Age of Software

- 1970s
- Signs of things to come
- Commission on New Technological Uses of Copyrighted Works¹
- Berkeley Software Distribution (BSD)
- Stallman's printer²

¹Lemley, M., Menell, P., Merges, R., Samuelson, P. and Carver, B. (2011) *Software and Internet Law*, 4th edition, Wolters Kluwer. (p. 32)

²Richard Stallman (2010) *Free as in Freedom (2.0)*, Free Software Foundation. (p. 4)

Middle Age of Software



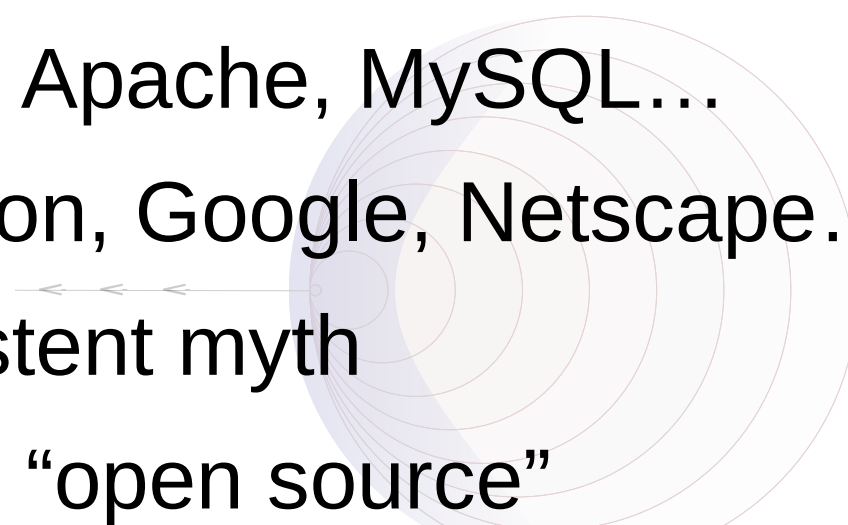
Middle Age of Software

- 1980s
- Software subject to copyright law¹
- Apple, Microsoft, Oracle...
- Free Software Foundation²
- Equal & opposite reaction
- Myth of proprietary innovation

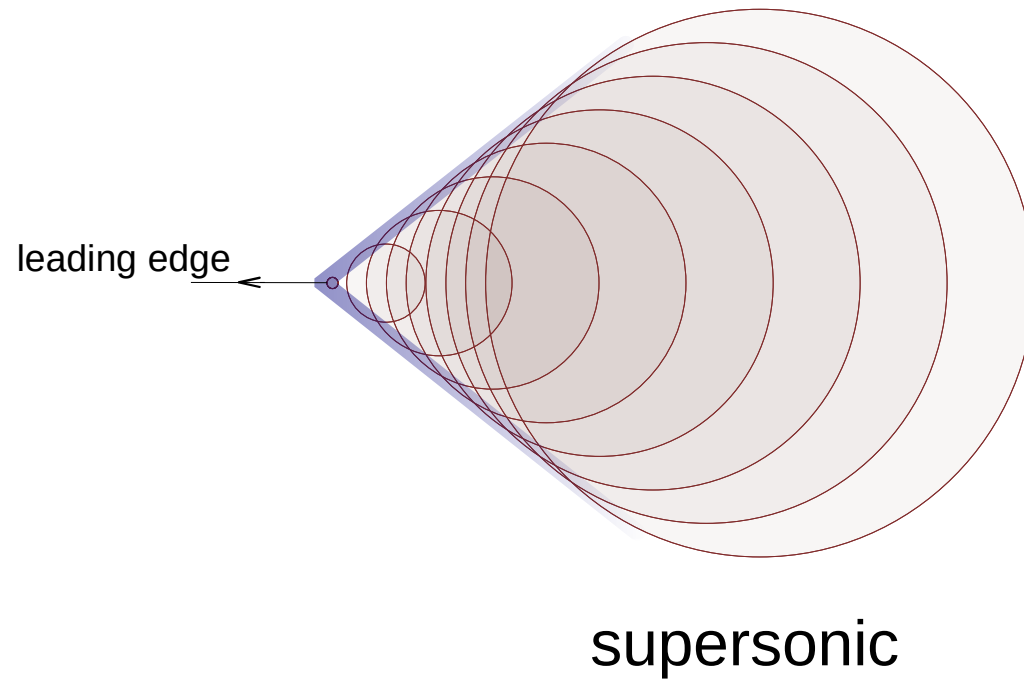
¹Merges, R., Menell, P. and Lemley, M. (2012) *Intellectual property in the new technological age*, Wolters Kluwer. (p. 433)

²Richard Stallman (2010) *Free as in Freedom (2.0)*, Free Software Foundation. (p. 9)

Middle Age of Software

- 1990s
 - Linux, Apache, MySQL...
 - Amazon, Google, Netscape...
 - Persistent myth
 - Name “open source”
- 
- A decorative graphic consisting of several concentric circles in shades of blue and purple, centered behind the text. A horizontal line with three arrows pointing to the left is positioned between the third and fourth bullet points.

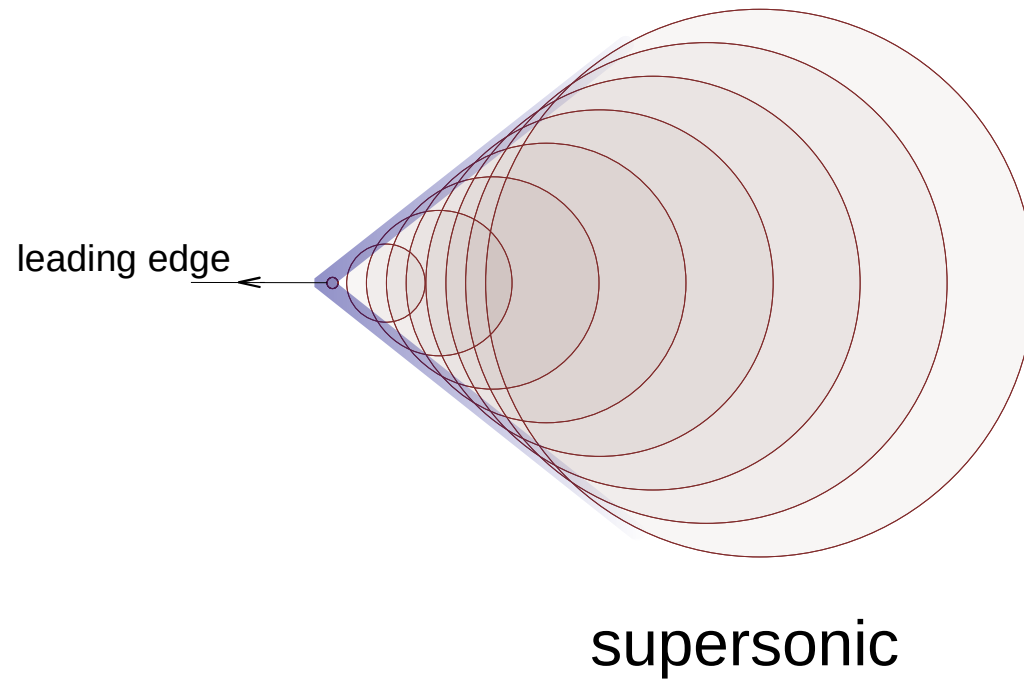
Modern Age of Software



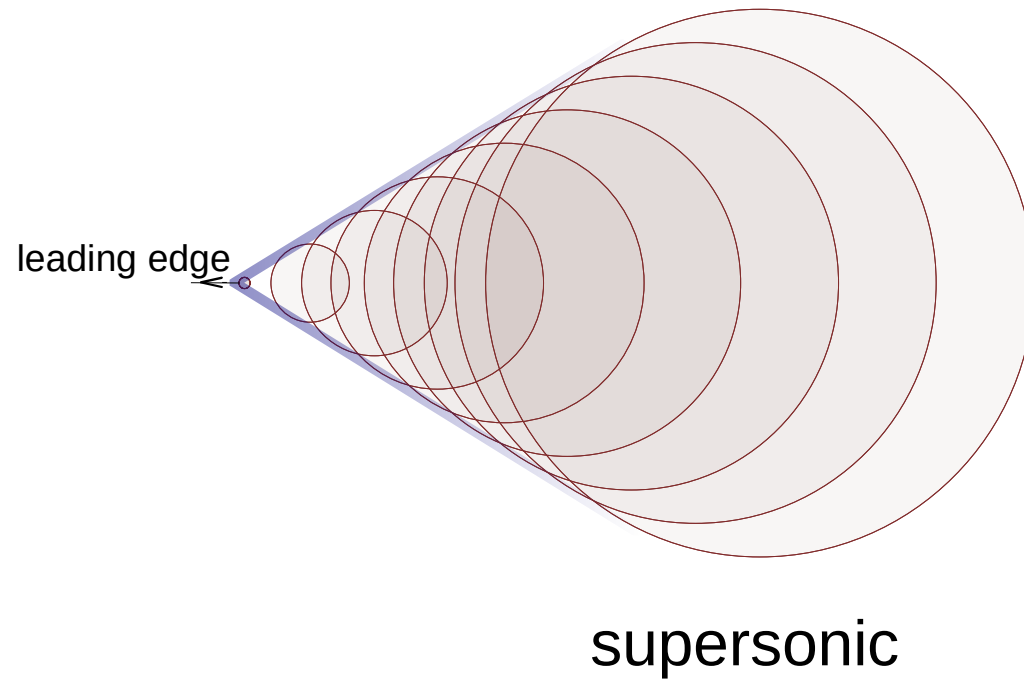
Modern Age of Software

- 2000s
- Corporate adoption of open source
- Economic necessity (dot-com bubble)
- Leading innovation (Web 2.0)
- Growing body of open source
- Proprietary hinders innovation
- We won?

Modern Age of Software



Modern Age of Software



Modern Age of Software

- 2010s
- Use is merely table stakes
- Participation is competitive advantage
 - Needs understood (bugs & features)
 - Reduced cost of maintenance
- Snowball effect
- Combined efforts accelerate innovation

2010, 2015, 2018 Surveys

- Use: 42% → 78%¹ → 92%²
- Participation: 64%¹
- Expect to contribute more: 88%¹

¹Black Duck Software (2015) *Future of Open Source Survey Results*, <https://www.slideshare.net/blackducksoftware/2015-future-of-open-source-survey-results>

²Tidelift (2018) *Professional Open Source Survey Results*, <https://blog.tidelift.com/our-2018-professional-open-source-survey-report-is-now-available>

2017 Survey

- Successful open source participation
- Theoretical background

Open Source & Innovation

- What makes companies successful?
 - at open source
 - at technology innovation
- The two have a lot in common

Open Source & Innovation

- Organizational capabilities¹
 - knowledge of individuals
 - business process and model
 - can be learned, over time
 - impacts likelihood of success

¹Löfsten, H. (2016) 'Organisational capabilities and the long-term survival of new technology-based firms', *European Business Review*, vol. 28, no. 3, pp. 312-332.

Open Source & Innovation

- Open Innovation¹
 - share ideas externally
 - assimilate external ideas inward
 - (open source: share and assimilate code)
 - create and capture value for customers
 - co-develop across company boundaries

¹Chesbrough, H. (2003) *Open Innovation: The New Imperative for Creating and Profiting from Technology*, Harvard Business School Press.

Open Source & Innovation

- Levels of Engagement^{1 2}
 1. InnerSource
 2. Use
 3. Product integration
 4. Single company project
 5. Participate in external project
 6. Co-lead external project
- More investment, more effective, more value

¹Westenholz, A. (Ed.) (2012) *The Janus Face of Commercial Software Communities — An Investigation into Institutional (Non) Work by Interacting Institutional Actors*, Copenhagen Business School Press, Frederiksberg.

²Ciesielska, M. & Westenholz, A. (2016) 'Dilemmas within commercial involvement in open source software', *Journal of Organizational Change Management*. vol. 29, no. 3, pp. 344-360.

Open Source & Innovation

- Across company boundaries
 - strategic alliances
 - standards bodies with patent pools
 - internal and outsourced R&D
 - licensing as acquisition

Open Source & Innovation

- Economics/business of software
- Customer value
- Proprietary model
 - Depends on scarcity
 - Fails on commodity
- Open source model
 - Freely available resource
 - forest → firewood → lumber → house → furniture

Software Business Models

- Hardware
- Software integration
- Software as a Service
- Support/Services
- Content
- ~~Software license~~

Shared Characteristics

Characteristic	Technology Innovation	Open Source
collaboration in external communities (knowledge and resources)	2, 3, 17, 26, 27, 30	8, 11, 14, 16, 19, 21, 28
access to external innovation (source code)	3, 5, 17, 29	8, 16, 19, 24
share ideas outward	3, 4, 26, 27	8, 11, 19
organizational learning, assimilate ideas inward	3, 5, 6, 7, 17, 23, 27, 29, 30	8, 10, 19
efficiency of reuse/modification	3, 5, 17, 27, 30	8, 9, 16, 18, 19, 21
strategic approach to customer value	3, 25, 26, 27	1, 12, 13, 19, 22, 24
low barrier to entry	20	16, 19, 24

¹Asundi et al. (2012)

²Bigliardi & Galati (2016)

³Biloslavo (2005)

⁴Chesbrough (2003)

⁵Chiesa et al. (1996)

⁶Chiu et al. (2016)

⁷Christensen (2000)

⁸Ciesielska & Westenholz (2016)

⁹Dahlander & Gann (2010)

¹⁰Harison & Koski (2010)

¹¹Henkel et al. (2014)

¹²Kort & Zaccour (2011)

¹³Krishnamurty (2005)

¹⁴Lerner & Tirole (2002)

¹⁵Löfsten (2016)

¹⁶Lundell et al. (2010, 2011)

¹⁷Martínez-Román & Romero (2016)

¹⁸Mattmann et al. (2012)

¹⁹Morgan & Finnegan (2014)

²⁰Pisano (2016)

²¹Rajala et al. (2012)

²²Riehle (2012)

²³Rubera et al. (2015)

²⁴Shanker (2012)

²⁵Sullivan (2000)

²⁶Teece (2000)

²⁷Vakili (2016)

²⁸Westenholz (2012)

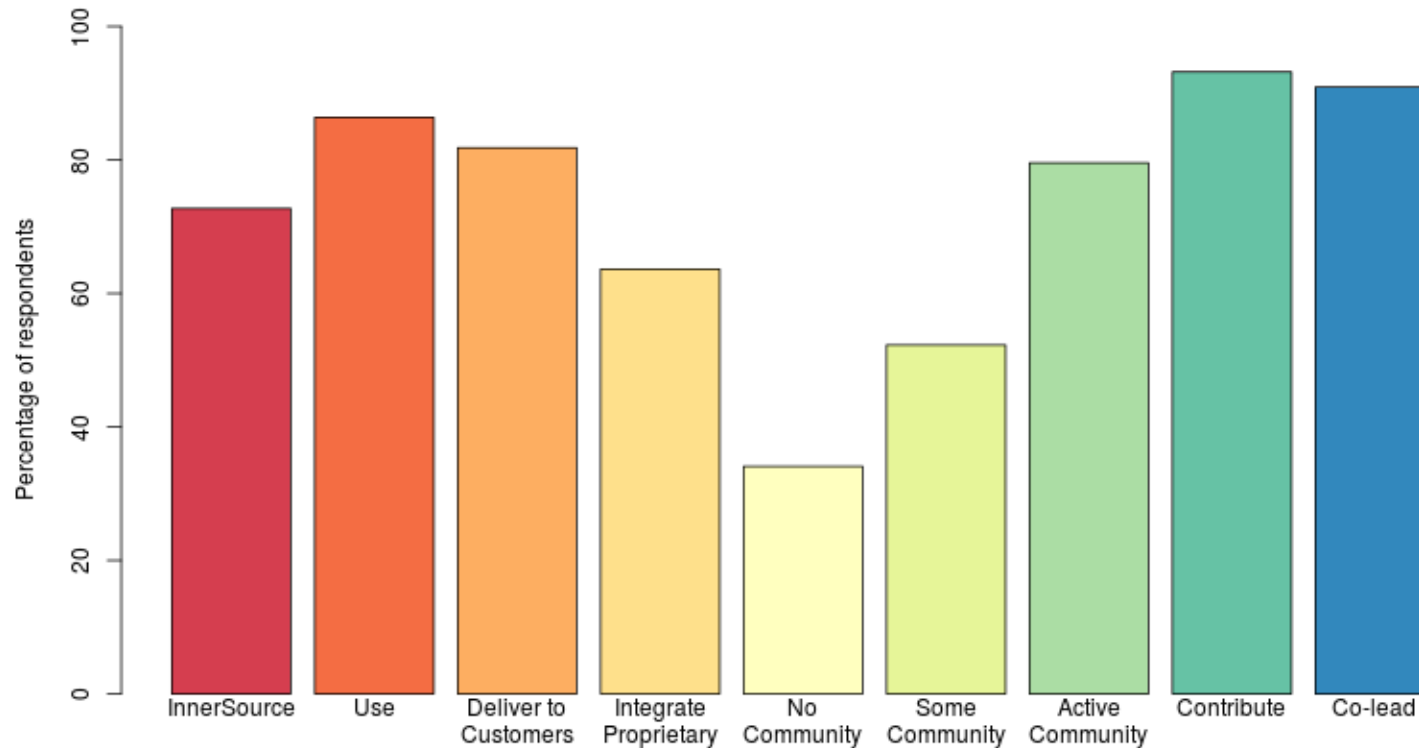
²⁹Yam et al. (2004)

³⁰Zhao et al. (2016)

2017 Survey

- Successful open source collaboration
- Companies involved in OpenStack
- Range: small startups to Fortune 50 (>300k employees)
- Active investment in open source

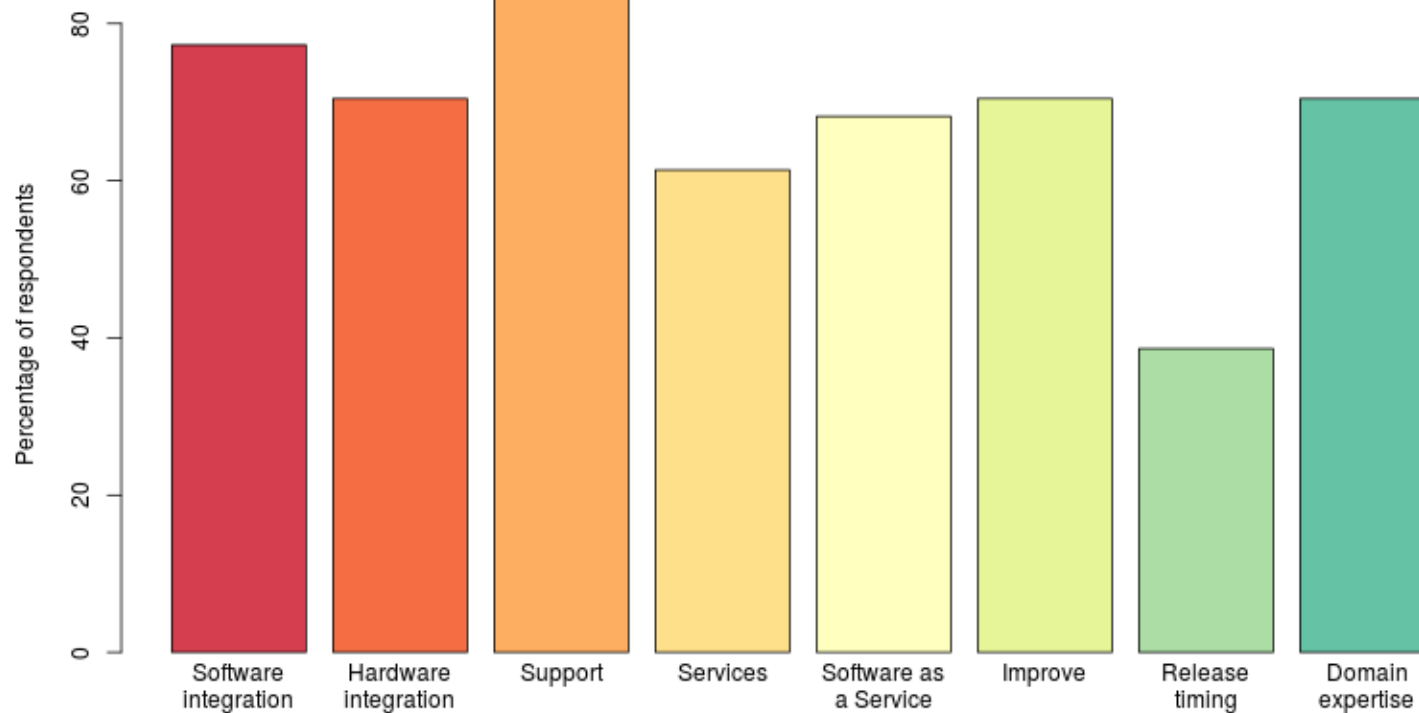
Styles of Engagement



Styles of Engagement

- Most common:
 - contribute to community, 93%
 - participate as co-leaders, 91%
 - research predicts these would be less common
- Least common: open source with no community, 34%
- Integrating open source, 82%, more common than proprietary, 64%

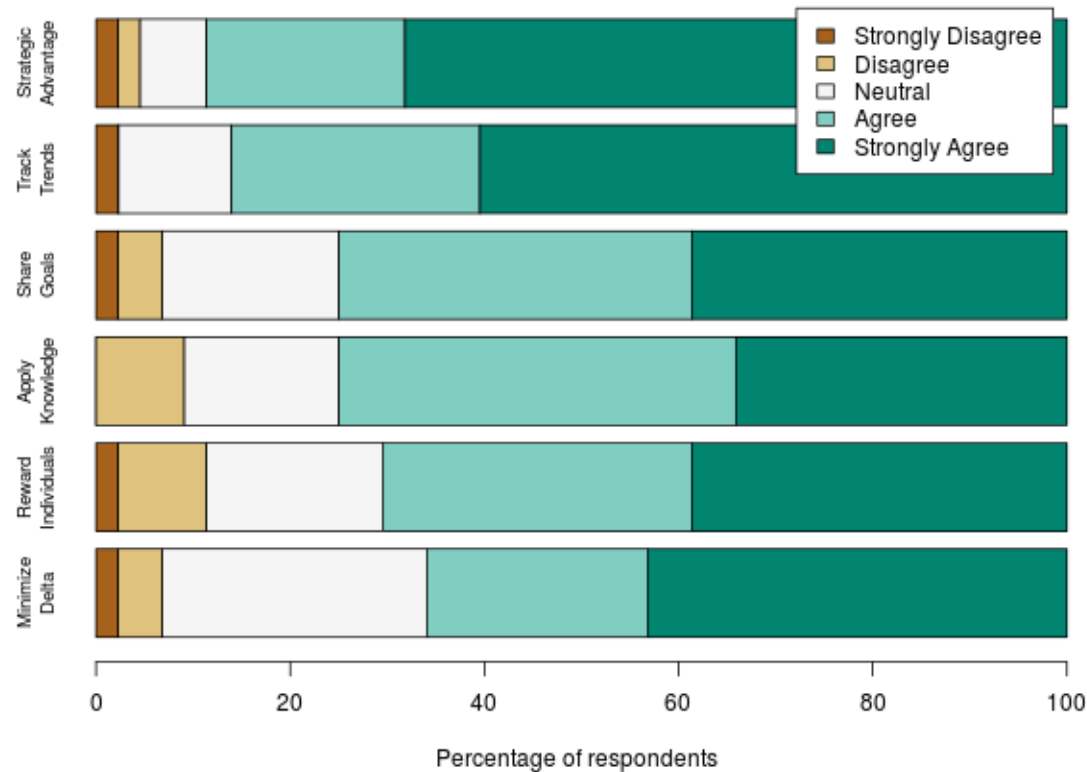
Areas of Business Value



Areas of Business Value

- Most common:
 - support, 86%
 - software integration, 79%
- Correlations:
 - integration with distribution
 - contributing with support
 - active community with domain expertise
 - no community with SaaS

Participation Practices



Participation Practices

- Most common:
 - regard open source as strategic component of competitive advantage, 90%
 - track open source trends for impact on business strategy, 86%
 - sharing and assimilating knowledge, 75%

What Works (and What Doesn't)

- More than a name
- More than a license
- Avoid “faux-pen” source
 - Open Core¹
 - Commons Clause² license condition
 - New Year's resolution?
- No guarantee
- Best practices

¹Phipps, S. (2010) 'Open Core is Bad For You', *ComputerworldUK*, <https://webmink.com/essays/open-core/>

²Vaughan-Nichols, S.J. (2018) 'Open-source licensing war: Commons Clause', *ZDNet*, <https://www.zdnet.com/article/open-source-licensing-war-commons-clause/>

Open Collaboration

- Open source
- Open development
- Open design
- Open community

Open Collaboration

- Co-leadership (strongest)
- Contribution
- Active community
- Some community
- No community (weakest)

Open Governance

- Developers and users have a voice
- Adapt over time
- Respond to opportunities and problems

Open Integration

- Internally
 - Strong integration points
 - Well tested, work well together
- Cross-project
 - Independently consumable
 - Users combine technologies
 - >50k projects in Debian
 - Opportunities for collaboration

Technical Best Practices

- Documentation
- Code review
- CI/CD
- Bug handling
- Security

What's Next?

- Unlikely to disappear
- Commoditization happens
- Growing body of open source
- Increasing participation, sustainability
- Proprietary niches of scarcity
- Business as usual

Questions?

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