# Open Source

## The Church of Emacs

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# Overview

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Open Source...

- Benefits users
  - Protects liberties
  - No DRM
- Is practical
  - No vendor lock in
  - Extensible
  - Repurposable
- Is good for the economy
  - Free of cost
  - Open innovation
  - Skilled community
- Is secure
  - Community of bug fixers
  - Provably secure instead of obscurity

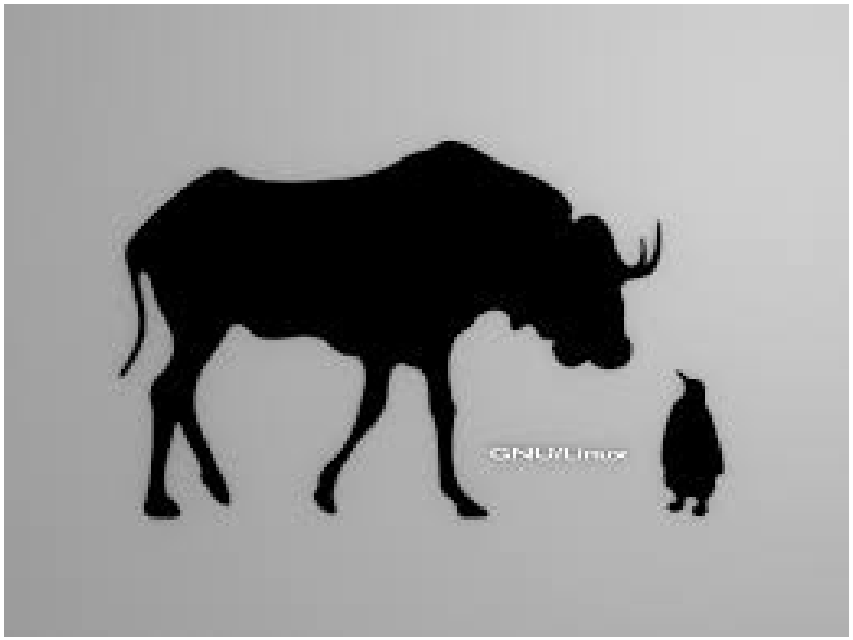
# Summary

# The Four Freedoms of Free Software

- Freedom 0 is the freedom to run the program as you wish
- Freedom 1 is the freedom to study the source code and change it, so the program does your computing the way you wish
- Freedom 2 is the freedom to help others. That's the freedom to make exact copies and redistribute them when you wish
- Freedom 3 is the freedom to contribute to your community. That's the freedom to make copies of your modified versions, if you have made any, and then distribute them to others when you wish

# The GNU Project and the Free Software Movement

- Stallman launched the Free Software movement in 1983
- He developed GNU - GNU's Not Unix
- Hacker spirt to joke around about serious issues
- Developed for freedom of users
- GNU+Linux or GNU/Linux

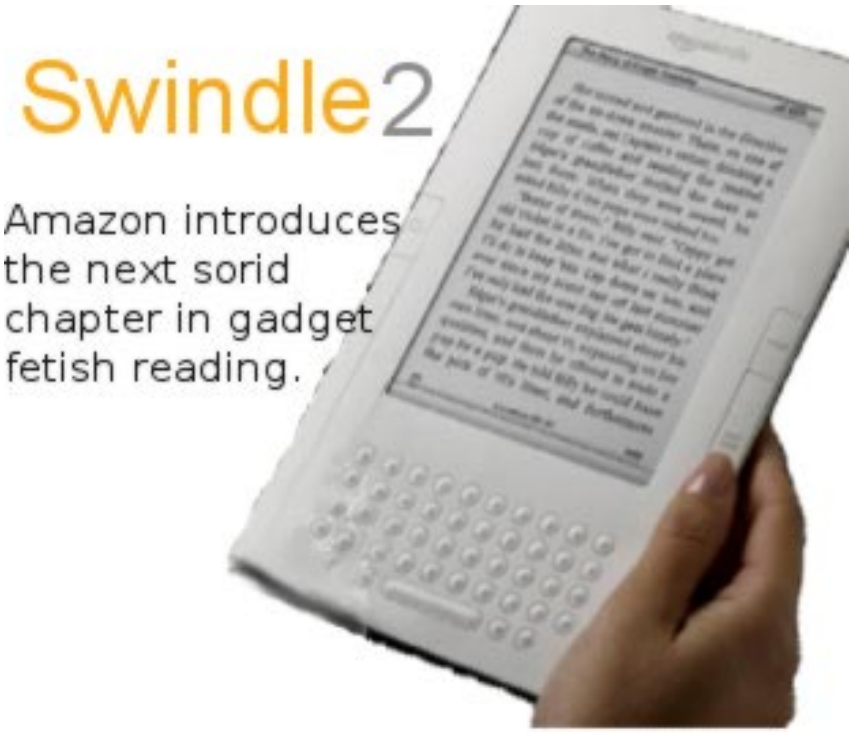


# Free Software and Education

- Schools must teach exclusively free software
- Teaching windows teaches dependence
- To become a good programmer, one must read lots of code
- Free software fosters sharing and helping

# Surveillance

- Can record anything on a computer
- Amazon users identify selves when buying books
- Mobile phones transmit location
- Need control over software
- Computer surveillance centralizes information



# Censorship

- Arbitray shutdown of sites in Spain
- Denmark secretly blocked sites
- A country that imposes censorship is not
  - free
  - legitamte

# Restricted Data Formats

- Prevents interoperability
- DRM is digital handcuffs
- Only happens in non-free software
- VC1, Flash, MP3

# Software That Isn't Free

- Free as in *libre*
- Free software respects a user's freedom
- The user controls free software
- Backdoor

# Internet Services

- Server could abuse data or take control
- Never trust data to a US company - Patriot Act
- Do things remotely with your own server
- Doing things digitally should not require loss of rights

# Computers for Voting

- Can't trust computers for voting
- Neither free or non-free software can be used
- If non-free software is used, company controls voting
- If free software is used, whoever runs the machine is in control
- Ballots can't be recounted with digital voting

# The War on Sharing

- Technology makes it easy to copy published works
- Those who have power over distribution do not want sharing
- Suing teenages for hundreds of thousands of dollars for sharing
- DMCA makes free software that circumvents DRM illegal
- Streaming media requires proprietary software
- Users should have their own copy of media

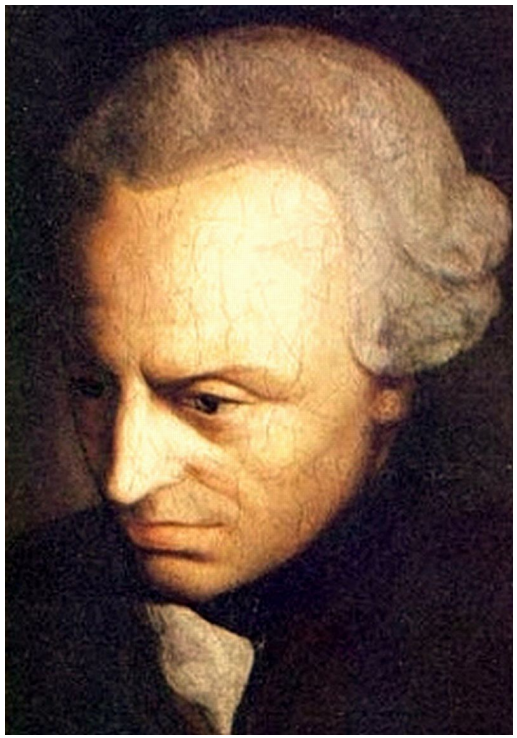
# Rights in Cyberspace

- No firm right to do things in cyberspace
- Need support of ISP to have website
- Need support of payment company to get paid
- US government had Amazon cut off service to WikiLeaks
- Also had PayPal cut service from WikiLeaks
- Need to have same rights in physical and virtual worlds

# Analysis

# Stallman's Argument: Basis

- A deontological standpoint
- Stallman as an ethical essentialist
  - proprietary software
  - restricted data formats
  - internet services
  - surveillance
  - "always bring up [free software] as an ethical issue" (Stallman, 2011, para. 63)



(*Immanuel Kant (painted portrait)*, 2014)

# Stallman's Argument: Logos

- Deductive reasoning
  - tobacco and proprietary software comparison (Stallman, 2011, para. 55)
- Contradictory premises
  - dismissing economics of free digital society (para. 34)
  - later addressing economics of digital media (para. 109)

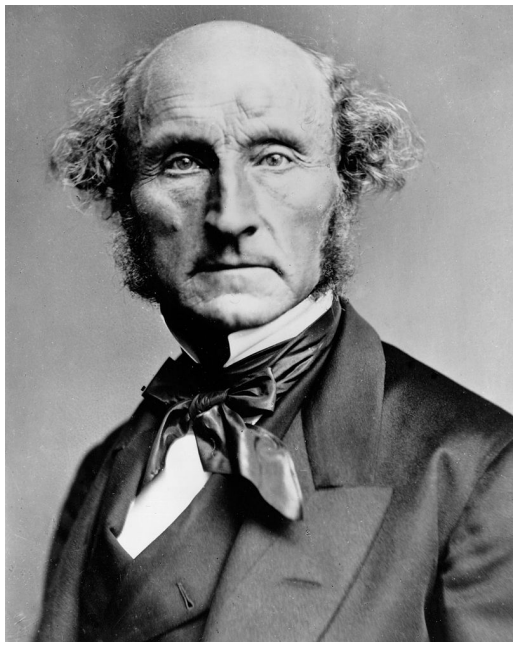
# Stallman's Argument: Pathos

- Use of strong characterizations
  - "Computers are Stalin's dream" (Stallman, 2011, para. 3)
  - All DRM should be illegal (para. 30)
- Strong appeals to tradition
  - values derived from a non-digital society
  - Amazon Kindle (para. 98)
- Calls Amazon Kindle (para. 98)
  - an immediate end to digital surveillance
  - "you can't wait until there is another dictator" (para. 13)

# Practical Advantages of Open Source

# Software for Freedom vs. Freedom for Software

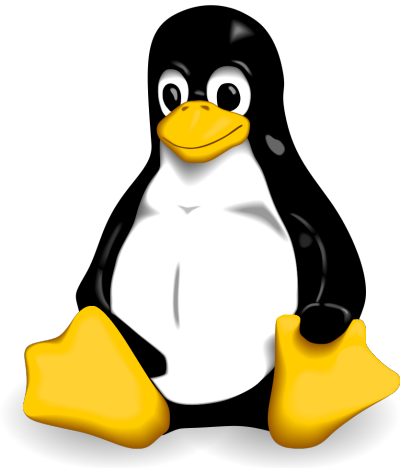
- Needs fulfilled by free software
  - a need for software
  - a need for ethical software and practices
- Stallman's emphasis on a "free digital society"
- Consequentialist stance on free software
  - open source vs. free software
  - a less radical approach
  - weighing the utility of open source
  - need-driven software (Bisson, 2007, p. 17)



(*John Stuart Mill by London Stereoscopic Company*, 2014)

# GNU + Linux, GNU/Linux

- The GNU operating system
  - "written for your freedom" (Stallman, 2011, para. 48)
- The need for a kernel
  - 1990: GNU Hurd
  - 1991: Linux
- Fusion of Linux and GNU
  - GNU + Linux, or just Linux?
  - Torvalds vs. Stallman



(*Tux*, 2012), (*Heckert GNU white*, 2011)

# Linux: open source success principles

- Using / creating the best tools for the job
- Not started with open source in mind (Torvalds, 2016, 3:30)
- Open source contributions
  - GPL and copyleft
  - Collaborative efforts and development
  - Formation of a communities around open-source code
- Flexibility
  - Availability of source code promotes reuse
  - power saving on Linux cellphone benefit Linux supercomputers (Zemlin, 2013, 11:34)

# Another Success Story: Apache HTTP Server

- Most popular web server since 1995
- Open source project
- Inherited the NCSA Common Gateway Interface.
- Repurposed software components
  - enabling efficient software development (Bisson, 2007, p. 17)


(*Feather*, n.d.)

# Preventing Obsolescence

- Vendor lock-in
  - warned against by Stallman (2011, para. 54)
- Proprietary software creates vendor dependency
  - maintenance
  - updates
  - support
- Case Study: Electronic voting machines (Colannino, 2012, p. 916)
  - migration to electronic voting machines
  - software escrow
  - code was licensed for testing, not deployment.

# Quality Assurance

- Linus's Law
  - 6,782 lines of code added/subtracted from Linux daily (Zemlin, 2013, 12:03)
- Software peer-review
- Core developers and user developers
- Mozilla bug reports (Wang, Shih, & Carroll, 2015, p. 352)
  - value differences
  - skill differences
  - reciprocal skill transfer
  - disorganization preventable

(*Mozilla Firefox logo 2013*, 2014)

# Economic Advantages of Open Source

# Apache Web Server

- 66% of major sites (Powell, 2012, p 696)
- Web server development is expensive
- Lowers requirements for web companies
- Allows publication of ideas and research

# Open Simulator

- Open entrepreneurship case study
- Powerful developer network
- Used to start software companies
- Sharing benefits all parties
- (Yetis-Larsson, Teigland, & Dovbysh, 2014)


(*OSCC13 Track Leaders Meeting in UCI vLab*, 2013)

# Red Hat

- $524M in revenue last quarter (Red Hat Inc., 2015, p. 24)
- Red Hat Enterprise Linux
  - “Free” alternative CentOS
- Support & Certifications
- Software licensed by GNU GPL
- Open technologies (ex. GlusterFS)

# id Software

- Creators of Doom and Quake
- Example of delayed open source
- Doom engine
  - Cutting edge technology when released
  - Eventually outperformed by competitors
  - Open sourced engine 1997
  - Continued to sell content packs for engine
  - (Caulkins et al., 2013, p. 1188)
- Makes economic sense for companies to open source
- (Caulkins et al., 2013)

# Economic Benefits

- Efficient use of human resources
- Reuse of works
- Shared knowledge
- Lower costs
- Greater quality of living
- Powerful community

# Security Differences between Open Source and Closed Source

# Security Through Obscurity

- Malicious hackers cannot see source
- Any code found is obfuscated
- In-house code reviews find bugs
- Developers have time to correct bugs

# Security Through Transparency

- Community will find bugs
- Developers less likely to inset malicious code
- Users that find bugs can propose fixes quickly

# Microsft Office and Apache OpenOffice

- Microsoft Office had 108 total vulnerabilities
- OpenOffice had only 16
- Similar number of low severity vulnerabilites as listed by CVE
- Microsoft had 7 times as many medium and high severity ones
- Numbers could be influenced by speed of Apache's patches
- (Schryen, 2009)

# Source Dependent Attacks

- Buffer Overflow
- SQL Injection
- Patch Reverse Engineering
- (Clarke, Dorwin, & Nash, n.d.)

# Source Independent Attacks

- User Participation
- Brute Force
- Protocol Vulnerability
- Inside Jobs
- (Clarke et al., n.d.)

# Conclusion

# Practical Advantages

- Open source has practical advantages
- Hard to learn about workings of closed source
- Open source empowers users

# Economics

- Entrepreneurs can build off OSS
- Lowered entry costs foster innovation
- Open source business offer value to others
- Easier maintenance of legacy code

# Security

- Gives users confidence
- Active community minimizes vulnerabilities
- Same community deters malicious code

# Closing Thoughts

- Stallman's ideas are not as radical as they seem
- Open source promotes freedom and learning
- Gives developers a starting point
- Suited for tinkerers
- Helps users feel involved and invested

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