Underpinnings of Copyright
or, “Life, Death, and Copyright, Really”

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Context: My interest in copyright

• Began in “pure” mathematics
  – concerned with social understandings of math
• Switched to law
  – Concerned with social and legal understandings of technical artifacts
  – Practiced commercial law in NY
• Software safety: software personal injury! [Th25]
  – At issue: “control” of rights in safety-critical code
    • How can industry progress without disclosure? [Pet]
• Hired to teach CSC “Professional Responsibilites”
Directions for this talk

• What is copyright?
• Broad social understandings of copyright?
  – social purposes and directions for copyright
  – a problem due to copyright of software *object code*
    • Privatization of critical social information

• Only a little legal analysis
  – no deep discussions of things like the DMCA
• Only a little technical minutiae
  – Useful here only insofar as it illustrates general social understandings
• Preliminary work: I want to get this to a conference and develop it more
My Concern: Privatization of Critical Social Information

- Copyright impedes software accident forensics
  - Therac 25 case illustrates this
  - impedes progress in software “state of the art”
- Breach of “social bargain” struck by government in giving limited monopoly to authors
  - society does not receive the “ideas” in exchange for the “rights” we grant by copyright
  - there are serious consequences to this trend!
What is “copyright”?

- Essence: “copy” - “right”
  - common definitions of these words?
- An abstraction created by government
  - to what end?
    - utilitarian vs. natural rights theories at play
Humble Beginnings

• 15th century Stationers’ Guild
  – guild register for books
  – private enforcement system to regulate book trade
    • agreement to uphold their monopoly
  – involved perpetual rights

• Subsequent Licensing Acts
  – monarchy found stationers’ system useful in suppressing dangerous speech
  – promoted dissemination of certain works to certain people
    • but also censorship
A Fresh Start in 1710

• Statute of Anne: parliament made a change!
  – Rights given to authors, not publishers
  – Utilitarian focus - to *induce the learned to publish*
  – Social purpose - to *promote learning*
  – Rights established only for *new* books
    • older works fell into the *public domain*
  – Rights had limited duration (14 years!) - *abolished perpetual rights*
  – Rights were limited to printing and reprinting,, not *use* of works
  – Publishers responsible to *deposit copies* in libraries
  – System to redress grievances about *overpricing!*

• For history, see [Rose]
Later: U.S. Constitution
Article I, Sec. 8, Clause 8

- Congress empowered to promote progress of science and useful arts
- by securing to authors and inventors
- exclusive rights
- for limited times
- in their respective writings and discoveries
Contours of the Constitutional View

- **Purpose:** promote science / useful arts
- **Who:** authors
- **How:** exclusive rights
- **How long:** limited times
- **For what:** writings
Underlying Economic Model

We grant authors:
– exclusive rights
  • a limited monopoly on expression of ideas

Authors grant society:
– publication
  • promotes science and useful arts to freely disseminate new ideas
– ideas and information go to public domain immediately
– limits on duration
  • enrich public domain thereafter
The “Bargain”

• Said to be a “social bargain” where copyright holder gets the limited monopoly and society gets resultant benefits
  – fundamental to the whole scheme: disclosure of the valuable “stuff” from the work
    • see [Lit] and [Sam] for more arguments and explanation
  – not a “natural rights” property model
    • a utilitarian model with a particular underlying rationale for costs, benefits, and who gets what
Some Distinctions in Rights

**Patent:**
- for “inventions”
  - protect functional aspects
- independent discovery is still a violation of rights
  - “copy” is not essential
- publication of ideas and careful explanation of invention required
  - protection only granted for what is disclosed
- limited to ~17 years

**Trade Secret**
- common law, not Federal
- does not require any publication
- a contract theory to keep secrets
  - lasts as long as the secret does
Enter Software

• Software basics
  – source code vs. object code (compilation)
    • object code very difficult to read or understand
      – it doesn’t reveal its underlying logic and ideas by itself
    • understanding requires experts, expensive tools and time

• Is software subject to copyright?
  – law says software is a “literary work” (1976)
  – *Apple v. Franklin* says object code is copyrightable (1984)
Uniqueness of Software

• Computer as general purpose machine: inert without software

• Software comprises the *information* to instruct the machine, giving it *function*
  – source code as expression of that function
  – object code as a translation of the *expression* of function into the *function itself*?
New Economic Incentives

- Don’t publish source code!
  - publication would reveal innovative designs and ideas to competitors
  - keep it secret (trade secret law)
    - protection lasts as long as the secret does
Copyright Still Useful to “Author”

• Copyright the object code (it gets to the market!)
  – prevent others from copying its exact functionality
    • unless copying technology makes pirating easy :-)  
  – little risk of revealing underlying ideas in the code
    • what happened to the social benefits of copyright?
  – can get up to 95 years of protection!
    • for software?!
• Additional efforts on behalf of “authors” to protect these rights:
  • restrict reverse engineering! Don’t let the public see the innovative ideas embodied in the expression! That is where the value to software is seen.
    – decompiling is already hard and expensive
    – use licensing restrictions (UCITA, formerly UCC Art. 2B)
    – restrict reverse engineering activities by law (DMCA)
An Important Detour

• Safety analysis primer:
  – engineering progress depends on open social discussion of disastrous designs [Pet]
  – software engineering processes focus on communication of underlying design ideas [Par]
  – *Source code* is central, among other components, to effective accident investigation [Lev]
Unintended Consequences of Copyright Incentives?

- Therac-25 medical linac case
  - several injuries and deaths
  - software defects implicated
- Hospitals had “killed” patients due to the machine
  - wanted to do some analysis for its safety
  - the manufacturer refused to release source code to hospital experts for internal analysis
    - claimed they needed to keep control for safety reasons!
      - not an irrational argument!
    - claimed trade secrecy on the underlying source code
A Fortuitous Event (for the state of the art in software)

• Consultation with hospital in case
  – I had the materials relevant to an analysis
    • this information considered proprietary after settlement
    • court records to be sealed after settlement ($$)
  – I was a graduate student wanting to publish :-)
    • discussion with manufacturer’s attorney revealed opposition to use of materials AND a special Texas rule!
      – not common attorney behavior
      – not a common rule among other Courts (unfortunately)
Progress through Publication of Therac Proprietary Information

• Software systems analysis
• Software source code forensics
• Software engineering process
  – testing and analysis methods
A Related Phenomena

• Consider “Open Source” software movement
  – Linux network servers
    • insurance rates lower when compared to Microsoft (proprietary, closed source) network servers
    • wow, something is going on when the source is disclosed to the public
Final Thoughts

• Public safety is in jeopardy due to natural rights view of software source code!
  – US Constitution envisions a different incentive structure for copyrights
• Should safety-critical software be subject to an “open source” law?
  – add patent protection for valuable algorithmic details
• Open records Court rules in cases affecting public health and safety
• Contact me with questions or thoughts: csturner@calpoly.edu
Selected Sources

[Lev] Leveson, Safeware, Addison-Wesley

[Lit] Littman, Digital Copyright, Prometheus


[Rose] Rose, “Authors and Owners: The invention of Copyright.” (general history of copyright)

Samuelson at www.sims.berkeley.edu/~pam/papers.html


*Some of my own software safety / legal research can be found on my webpage: www.csc.calpoly.edu/~csturner