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Without a significant realignment in licensing standards and widespread adoption of open source software in the health industry, the use of electronic medical records will not play the transformative role that many expect. Over the last twenty-five years, computer and network technologies have touched and revolutionized nearly every industry. This technology has given ordinary people the ability to access and update information on their bank accounts and investment portfolios, broadcast audio and video around the world, and maintain effortless communication with colleagues, friends, and family—regardless of location—using technology as simple and widely available as the cellular phone. Yet few patients and physicians have a simple, reliable, and shareable method of accessing and interacting with medical information.

Physicians are forced to rely on self-provided oral or written medical histories, incomplete drug information, and other physicians' ability and willingness to keep them abreast of important developments in a patient's care. While researchers and hospitals use cutting edge computer technologies for groundbreaking diagnostic imaging and visualization, the real benefits of using computer and network technologies in the operational aspects of health care lags behind the benefits realized in other industries. The unique characteristics of the healthcare industry and the compelling social need for less costly, more accurate, and more efficient health care, justify a realignment of licensing standards and the full-throated adoption of open source software at the policy and provider levels.

Closed, proprietary information systems and closed software licensing regimes are a big problem in the healthcare industry. A physician may have

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the ability to enter notes, test results, and diagnoses into a computer system that allows him and his staff to search, sort, monitor, and update that information. Typically, however, most other clinicians will not have access to that information on the same terms because most others will not have interoperable software to enable them to gain access to the data. Modern medicine frequently involves clusters of health professionals providing care who do not use common or compatible software, creating a significant barrier for any one clinician to see the whole picture. To the extent that the U.S. health system has adopted electronic medical records, those records still remain relatively isolated and inaccessible to other users of health information.

As a result, clinicians routinely rely on the memory and honesty of patients in determining that patient's existing pharmaceutical regimen and medical history instead of using a comprehensive summary of that information documented by other providers. Complete, reliable information about a patient is simply not available in a large number of clinical situations, and the lack of information leads to unnecessary and inappropriate care, costing money and causing injuries and deaths.

The reasons for these problems are many: concerns about patient privacy, rapidly developing technology, rising costs in other areas of health care, large numbers of independent health providers, and the complexity of medical information. Yet solutions to many of these problems are within the reach of existing technology, and both policymakers and the public are sensing ever more urgency to reap the profound benefits of a fully electronic healthcare system. Nevertheless, these problems will persist in substantially the same form and the U.S. health system will fail to realize the full potential of a digital health system as long as most medical information software is protected by existing copyright law and sold under traditional software licenses. Only by adopting and embracing open source, standards-compliant software can the healthcare industry can fully realize the hope of twenty-first century medicine.

I. THE PROBLEM WITH PROPRIETARY SOFTWARE

The problem with proprietary software in the healthcare industry is that the protections afforded to the software prevent users from sharing and modifying it. Commercial software in the healthcare industry is mostly an as-is proposition. Modifying the software to work with a different standard, to interface with different equipment or information systems, or opening it to a different network protocol, is frequently prohibited under the licensing agreement. Furthermore, sharing the software with colleagues, affiliates, or patients who have not separately paid for the software is also prohibited under the licensing agreement. That means that if one hospital's

information system is not the same as a neighboring hospital's, they likely cannot share information. It also means that patients have no access or ability to update their information stored in clinician computer systems. The restrictions on copying and modifying are perfectly reasonable from the standpoint of the software vendor: the right to make copies and to modify copyrighted work belongs to the copyright holder, and such a copyright holder is free to license the use of the software without granting the right to make copies or to make derivative works to anyone else. Most commercial software is licensed more or less along these lines, and vendors profit by selling as many copies of the software as they can.

An important thing about proprietary software is that vendors do not want their customers to switch to competitors' products but do want customers to upgrade to their new product. Software companies have an incentive to design their products with these goals in mind by making it difficult for customers to integrate, or transition to, competing products. While the most of the same can be said about word processors, web browsers, or other kinds of commercial software, this is especially true in health information systems. Large healthcare institutions have more complexities to manage, and more substantial costs and potential liabilities to incur than a typical business might encounter by switching from one word processor or email program to another. In this environment, hospitals are highly reluctant to change software, especially when doing so is a break from a vendor that has a functioning system in place already.

The large number of healthcare providers spread over different medical specialties, clinical environments, geographic, and socio-political environments, deploy an astounding array of different information technology solutions that do not work with one another, thereby capping their practical value. Vendors in the healthcare IT business zealously protect their market share, and software development that favors open standards, integration, and open access to software often conflicts with the basic economic reality that vendors face. Software information systems typically cost thousands, if not millions, of dollars. Outsiders to such software systems simply do not have any meaningful way to interact with that information without paying for and deploying a new software system that will continue to be incompatible with most other similar systems.

The players in the health information technology industry are incentivized to limit open standards and access to software because their business is based on selling more copies of their software: keeping existing customers away from competitors and competitors away from their customers. In short, it is an environment that discourages precisely the kind of integration that is needed to realize the improvements in cost, quality, and access that a digital revolution in healthcare IT promises.

The problems with current electronic medical record initiatives is that

they typically take the existing proprietary framework for granted. They provide subsidies to providers to purchase and deploy proprietary electronic medical records systems or provide subsidies for the development of proprietary electronic medical records systems. However, they ignore the reality of the widespread deployment of a cornucopia of different software solutions, designed to keep customers locked-in to a specific vendor, will fail to produce the hoped-for gains in cost, access, and quality.

II. OPEN SOURCE AS A SOLUTION

Open source software, (sometimes referred to as "free," though that term can be misleading), and in particular software licensed under the GNU General Public License (GPL) and related licenses, turns the traditional framework of incentives on its head. It promotes exactly the kind of integration and interoperability that the healthcare industry needs to obtain the cost, efficiency, and quality improvements that policymakers and the public are hoping for. Rather than prohibiting users from copying, distributing, and modifying software, software licensed under the GPL expressly authorizes users to copy, distribute, and modify software as much as the user likes, for no additional fee. Such software is often said to be "free," as in greater freedom in usage, rather than "free" as in zero-cost, though the ability to freely copy the software often makes both terms applicable. The most important caveats, however, are that distributed copies and derivative or modified versions of the software must come with the same license, and that the changes made by the user must be shared.

To many, the reaction to such an arrangement is that it is naive, utopian, and unrealistic. Nevertheless, a number of popular, highly sophisticated, and widely trusted programs are developed and licensed under the GPL. Examples include the Firefox web browser, the GNU/Linux operating system, the Apache web server (the software that runs more than half of all active websites on the Internet[1]), among others. Furthermore, open source software can be profitable even though the software itself can be freely copied. Even zero-cost software can be profitable because software developers can profit from providing the service, support, and customization that customers need. For example, Red Hat, Inc., a company built around the open source GNU/Linux operating system, reported annual revenues of $652 million and a net profit margin of 12% in 2009.[2] Rather than selling copies of software, open source developers profit by adding value to commonly available software tools. Furthermore, because other users have the ability to copy and modify the software and contribute their

1. Netcraft, Sept. 2009 Web Server Survey, *available at* http://news.netcraft.com/archives/2009/09/23/september_2009_web_server_survey.html.

2. Red Hat, Inc., Annual Report (Form 10-K) at 67 (Apr. 29, 2009).

developments to the community, the overall level of utility and value in the software increases for everyone.

In a world where healthcare information systems and electronic medical records are "free," neighboring hospitals with incompatible software environments can hire contractors to modify their existing systems to work with one another. Subsequently, the modifications they make to facilitate interoperability will become available to other institutions facing similar problems or can be formally incorporated into a future release of the software. The open source ethos and economic framework encourages developers and users to find ways to integrate and standardize information systems rather than to find ways to segment and separate in order to control individual market share. Rather than having health information confined in expensive software prisons, the interoperability that open source would facilitate would enable clusters of physicians and their patients to share the tools used to interact with health information and open up new possibilities for collaborative medicine. The ultimate result: more efficient and effective care. Fortunately, the basic framework for an open source electronic medical records system already exists. The Department of Veteran's Affairs has developed and deployed a system known as VistA (Veterans Health Information Systems and Technology Architecture), that could provide the basis for a wider adoption of open source methodology in the healthcare information technology industry.

Though the issues of patient privacy, data integrity, and resistance from entrenched interests in the healthcare information technology industry remain formidable challenges, the profound benefits of open, standards-complaint electronic medical records can be realized. Achieving these goals, however, will require a commitment from policymakers, medical providers, and information technology vendors, to embrace and support open source technologies and development methodologies.