

A Medsphere Systems Corporation Whitepaper

Transforming Healthcare Through Open Source

Edmund Billings, MD

Chief Medical Officer

Medsphere Systems Corporation



Medsphere[®]
Transforming Healthcare

Table of Contents

Healthcare and Health IT	1
The Three Major Barriers to Technology Adoption	1
Healthcare and Disruptive Innovation	2
Proprietary vs. Open Source.....	2
Why Open Source Is Ideal for Healthcare.....	3
How Open Source Addresses the Major Barriers.....	4
Affordability	4
Interoperability.....	5
Adoption	5
The VA and VistA	5
OpenVista and the Transformation of Midland Memorial Hospital.....	1
Midland’s Journey to Stage 6	3
No Longer Just Buy v. Build:.....	4
Buy	4
Build.....	4
Summary	5

Healthcare and Health IT

Well into the computer age, healthcare lags badly behind other industries in the adoption of effective and comprehensive information technology that facilitates greater efficiencies and improves vital functions. Even though most hospitals and physician practices have adopted electronic health records and other health information technology (IT) applications, the promise of better care, reduced costs and increased revenue remains unrealized. So, what happened to derail the healthcare IT revolution? Why is reality so much less inspiring than the projections of just a few years ago?

The answer lies not in technology itself but in the proprietary software business model and how it fails to serve the mainstream healthcare marketplace. The acceptance of the Open Source business model across other industries and the proliferation of Open Source companies—Linux, Red Hat, MySQL, JBoss—offers healthcare a roadmap to use in creating health IT that truly improves the care provided and enables dreamed-of efficiencies.

Well into the Meaningful Use program, as well as the second term of a presidential administration that made healthcare overhaul a policy priority, healthcare and health IT remain complex Rube Goldberg operations held together by the tireless efforts of clinicians and other support personnel. We are now acutely aware that hospital pricing has little rhyme or reason to it, and that health IT alone won't change it. We also know that most physicians are less than thrilled with their EHR systems, and that much development will be required in the not-too-distant future to engineer necessary improvements. While healthcare remains in unfamiliar territory, the faint outline of a map and a dimly lit horizon provide some, albeit rudimentary, guidance.

The problem with what we've learned to date is that the current path is not really working. Interoperability remains elusive. Health IT costs threaten to bankrupt hospitals and health systems, and they contribute to overall healthcare costs that could bankrupt the nation. Unnecessary complexity and plain old clunkiness have not segued into elegance and ease.

So, because of a demonstrable lack of efficiency and improvement, the barriers to *effective* use of information technology in healthcare are the same as they were a few years ago, when only a minority of hospitals and physicians had implemented EHR systems. How have we run so far to find ourselves so near the starting line?

The Three Major Barriers to Technology Adoption

The transformation of healthcare using health information technology (HIT) is still hindered by three primary barriers:

- **Affordability:** Proprietary systems remain prohibitively expensive and the vendors who peddle them ignore interoperability issues because they have no financial incentive to relax the chokehold they maintain on individual hospitals.
- **Interoperability:** While many systems support some interoperability through Health Level 7 (HL7), this interface standard often requires a great deal of time and money, as well as thousands of dollars, per interface. And there remains the challenge of getting different vendors to cooperate in pursuit of interoperability when it is not in their business interest or proprietary business model. This scenario creates islands of automation and data, and stifles information sharing and collaboration.
- **Clinical Adoption:** While the proprietary business model is based on getting the system up and running, getting clinicians trained and using the system is another matter; organizations are often on their own for this. With the cost of IT so high, many organizations cannot invest in adoption and most systems are written to maximize functionality, not enhance workflow.

Healthcare and Disruptive Innovation

When an industry's wares are not available to the bulk of the market as a result of prohibitive cost, then that the market is ripe for disruptive innovation. Clayton Christensen describes this situation in *The Innovators Dilemma*:

A disruptive innovation is a technology that brings a much more affordable product or service that is much simpler to use in the market ... and so, it allows a whole new population of consumers to afford to own and have the skill to use ... whereas historically, the ability was limited to people who had a lot of money or a lot of skill.

Christensen cites an interesting and representative example of this phenomenon: When televisions were expensive and required costly service and replacement of tubes, only a fraction of the market could afford them. Then Sony invented the transistor, which shook-up the predominant business model and made it possible for low cost retailers like Kmart to sell televisions. Both decreased cost and increased access expanded the television market to the middle class.

Proprietary vs. Open Source

The legacy business model, the proprietary approach, is defined as follows:

Something that is used, produced, or marketed under exclusive legal right of the inventor or maker; specifically, a product that is protected by secrecy, patent, or copyright against free competition as to name, product, composition, or process of manufactured.

- Merriam Webster's Collegiate Dictionary

In practice, this definition is unsatisfying and requires explanation. The proprietary business model promotes a capital software sale requiring an upfront licensing payment and a roughly 18-23 percent annual maintenance fee for support. Services and associated fees to implement, configure, install and train the system are required, and added complexity naturally leads to higher fees. Every enhancement or upgrade requires the customer to write another check. The ultimate goal—making the customer dependent on the vendor's proprietary wares and ways—generally yields low customer satisfaction and what customers call vendor lock or vendor fatigue.

Proprietary technology in the healthcare market clearly creates three segments: the 'have-a-lots,' the 'haves' and the 'have nots.' Since the 1990s, when work on the clinical applications that make up an EHR really grew, the industry has focused primarily on the have-a-lots, the early adopters with significant resources who make up roughly 15 percent of the market. As the industry progressed, every usage model and automated workflow became available as proprietary technology. These systems were developed by vendors working with the early adopters who had the necessary resources and wanted every bell and whistle. Not surprisingly, the industry responded to their best customers and the feature/function, beauty contest, bake-off culture of the software industry as a whole gained a foothold in healthcare.

Without question, feature functionality predominates in healthcare IT today. Because software development is expensive, most of the successful corporations have created hugely expensive systems that only the wealthiest hospitals and integrated delivery networks can afford. And recent evidence suggests that some hospitals and health systems have underestimated the cost of proprietary as they are forced to shutter small, affiliated facilities and lay off employees to cover the costs of EHR implementation and support.

The bake-off culture also rewards complexity and longer, harder implementations. It makes selling software the highest priority and incorporates no incentives for helping customers realize specific clinical and procedural goals unless an hourly development fee is associated. The bake-off vendors want to be the single source of IT for their customers.

Indeed, lack of interoperability and vendor lock are not unfortunate byproducts of an efficient system; they are crucial to the dependence business model, creating islands of automation and data that are difficult to use to improve processes. Proprietary healthcare IT may be good for generating revenue, but it has not been good for market share or expansion. This is a classic "Crossing the Chasm" problem (http://en.wikipedia.org/wiki/Crossing_the_Chasm).

In short, the proprietary model provides technology, but without a financial incentive it cannot provide what the customer really wants and needs: the transformation of care and business. Healthcare organizations must have some control over their systems to transform operations and the provision of care.

The innovation healthcare requires must address the major barriers identified previously, support mainstream health organizations in transforming the care they provide, and promote value-based competition.

Open Source offers healthcare the control and disruptive innovation the industry needs by supporting the affordable development of system software.

Open source is an approach to design, development, and distribution offering practical accessibility to a product's source (goods and knowledge) ... The open source model of operation and decision making allows concurrent input of different agendas, approaches and priorities, and differs from the more closed, centralized models of development. The principles and practices are commonly applied to the peer production development of source code for software that is made available for public collaboration. The result of this peer-based collaboration is usually released as open-source software ...

- Wikipedia

In the Open Source model, code is either free or very affordable and usually includes no upfront capital investment in the software technology. The client pays an ongoing subscription to the partner (vendor) for support and all future upgrades. Clients have full access to source code and can enhance it themselves if they want to with an eye toward both individual gain and contributing to the Open Source project. The access and transparency empowers healthcare organizations to use the system in transformative ways and reinvest money saved on proprietary licenses. In the Open Source model, healthcare facilities can invest in development and redesign, hire consultants and focus on getting the results they desire.

Why Open Source Is Ideal for Healthcare

Simply put, the provision of healthcare is a collaborative process and both the development of proprietary systems technology and the underlying business model are not. Intuitively, improvement of healthcare processes and clinical transformation also require coordinated collaboration efforts.

"Open source software is well suited for health care, as it mimics the evidence-based health model; it, too, engenders better outcomes and continual improvement."

-Forrester/chcf 2006

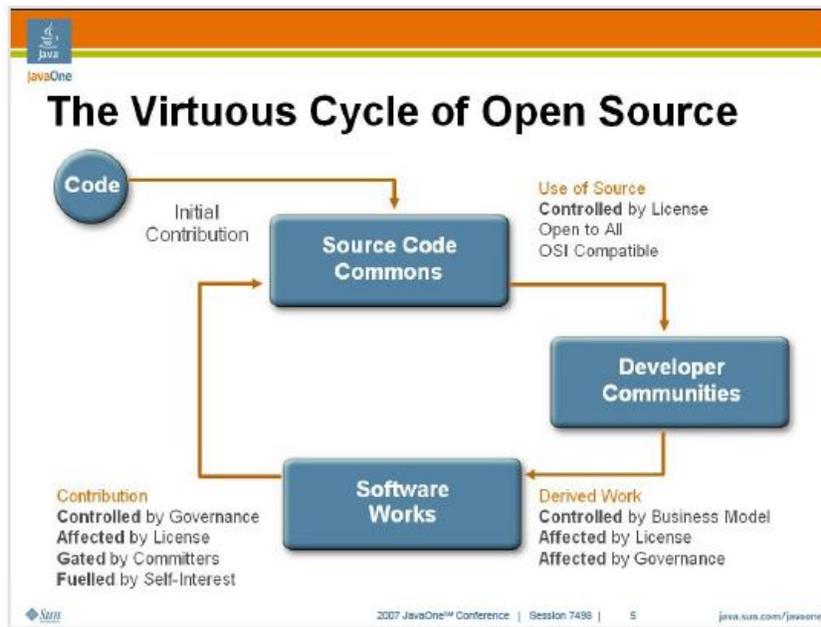


Figure 1: The Open Source Cycle

The experience of other industries demonstrates that Open Source is the most cost effective and best approach to securing and managing networks and data.

Oct. 2, 2007 – A Barracuda Networks survey revealed that IT security professionals have an almost equal preference for deploying open source software (53 percent) versus commercial software (47 percent) in their organizations for similar functionality. In the survey, 80 percent of respondents cited pricing as the top reason for adopting open source software over commercial software, while 57 percent selected access to source code and 41 percent chose community code review as the primary reasons for open source preference. “Businesses must control costs for IT,” said Dean Drako, president and CEO of Barracuda Networks. “The fact that open source software is now viewed on par with commercial software shows the gains it has made in becoming a viable element of business security solutions.”

Open Source incorporates the transparency needed to validate code used to secure a network. Unlike the vendor-certified black boxes that are the norm in proprietary development, with Open Source, IT management can access the code and assess performance.

How Open Source Addresses the Major Barriers

Affordability

The Open Source business model incorporates a five-year solution subscription that is much more affordable and flexible than traditional proprietary licensing models. Medsphere’s OpenVista, as a prime example, is generally 60-70 percent less expensive than many other solutions with no huge down payment required, making it attainable for small and mid-sized healthcare facilities historically un-served by the larger healthcare IT vendors. The integrated design of OpenVista enables implementations in one-third the time of other solutions, resulting in faster return on investment.

“Entry-level cost is a huge factor” for small to medium-sized hospitals and health systems, said David Whiles, Director of Information Systems at Medsphere customer Midland Memorial Hospital (MMH). “From a clinical standpoint, [OpenVista] is a very functionally rich system, and having a truly integrated system is a huge plus.”

Interoperability

The Mirth project is a prime example of how Open Source eliminates the challenge of interoperability. In Mirth, WebReach Corporation has developed an Open Source, HL7-compliant cross-platform interface engine as a commodity with additional value in ongoing support and upgrades. Mirth allows organizations to modernize legacy applications through HL7 interoperability, phase out antiquated messaging systems, and replace costly proprietary software. Designed, used and tested across a community that has grown to 5,000 members, Mirth is an easy-to-use, reliable engine and set of tools, as well as an extensive library of interfaces. With Mirth, IT departments can focus on issues more pressing than getting systems to talk to one another.

Adoption

Open Source supports adoption on two fronts: product design and affordability. Adoption is greatly supported by product usability and practicality. Products that are designed in Open Source environments are driven by broad community preferences, not early-adopter top-down processes. Open Source products are often simpler to use and less complex structurally because mainstream organizations and users look for straightforward interaction without superfluous functionality. And a solution that is one-third the price of a proprietary system enables the implementing organization to apply the money saved to driving adoption, providing one-on-one training and more computers, and increasing remote access.

The VA and VistA

Consider for a moment the product design of the U.S. Department of Veterans Affairs' Veterans Health Information System & Technology Architecture (VistA). While VistA did not actually begin as an Open Source project, per se, it was always a community driven collaborative design effort. Indeed, VistA development at the VA began as a covert operation (it was dubbed the 'Underground Railroad') that was not sanctioned by the agency. Over time, and as it became clear VistA was superior to the VA's above-ground efforts, the agency provided funding and support for development.

As part of an official project, VA developers and physicians began automating tasks and transactions in government hospitals and clinics to provide basic practical clinical functionality, later bringing these elements together as a comprehensive integrated support tool. In VistA they wanted to compile documents and patient records in one electronic form, thereby reducing medical errors, facilitating preventive care and simplifying statistical tracking of indicators through the use of a single database. The adoption of VistA by VA facilities is now total, resulting in remarkable clinical transformation:

- VistA is utilized at 1,400 sites, implemented across 31 countries with 200,000+ daily users.
- The VA is the first organization to develop and deploy BCMA technology; the VA is virtually free of medication errors (99.97 percent).
- Over 90 percent of all patient orders are entered directly by physicians. In a typical day, 931,000 orders are processed, 616,000 medications administered, 567,000 encounters documented and 534,000 images processed.
- VistA has over 1.2 billion orders online and is supporting over 8.5 million active patients.
- Roughly 65 percent of all U.S.-trained physicians since 1995 have used VistA during rotations. VistA has thus supported the rapid training of new physicians every two to three months.

While it still surprises many, VA care has been widely recognized as the best in the U.S., which has everything to do with VistA support for physician adoption and clinical transformation.

OpenVista and the Transformation of Midland Memorial Hospital

Vista's legacy of clinical transformation now extends into the commercial healthcare sector through OpenVista. Using OpenVista, Midland Memorial Hospital (MMH) achieved Stage 6 status as determined by the Health Information Management and Systems Society (HIMSS) Analytics organization. Stage 6 is the second highest level of HIMSS Analytics' Electronic Medical Record Adoption Model (EMRAM).

Stage	Cumulative Capabilities	% of U.S. Hospitals	
		2015 Q1	2015 Q2
Stage 7	Medical record fully electronic; HCO able to contribute CCD as byproduct of EMR; Data warehousing in use	3.7%	3.7%
Stage 6	Documentation (structured templates), full CDSS (variance and compliance). Full R-PACS	22.2%	23.6%
Stage 5	Closed loop medication administration	30.8%	32.3%
Stage 4	CPOE, CDSS (clinical protocols)	13.6%	13.2%
Stage 3	Clinical documentation (flow sheets), CDSS (error checking), PACS outside radiology	19.7%	18.2%
Stage 2	Clinical Data Repository, Controlled Med. Vocab, CDSS Capability	4.3%	3.6%
Stage 1	Ancillaries – Lab, Rad, Pharmacy	2.2%	1.9%
Stage 0	All three ancillaries not installed	3.5%	3.3%
	Total Hospitals	n = 5462	n = 5464

Data from HIMSS Analytics Database © 2014

Figure 2: The Electronic Medical Record Adoption Model

Importantly, and as illustrated in the graphics below, MMH achieved Stage 6 for about one-third the cost and in roughly one-third the average time of other initial Stage 6 organizations. Over five years, MMH invested a total of \$18,000 per bed, which was 73 percent less than the \$66,000 per bed average cost for the other Stage 6 organizations.

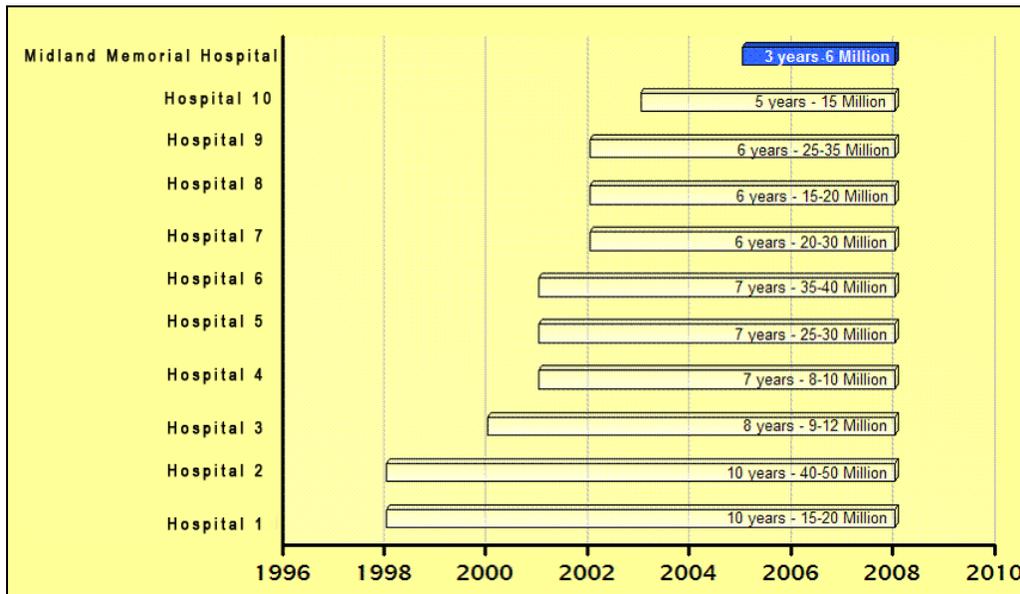


Figure 3: Estimated dollars and time expended in getting to Stage 6

According to Russell Meyers, Midland CEO, "Our ability to share information has made a tremendous difference to our doctors ... This was a no-brainer for us. OpenVista is a more economical solution, it's

proven and reliable, and I don't see any major advantages offered by more expensive solutions over what we've done."



Figure 4: Estimated cost per bed to achieve stage 6

Midland Memorial and Medsphere deployed OpenVista over fifteen months and went live in February 2006. The affordability of the system enabled the hospital to drive physician adoption through one-on-one training, additional computers and 438 remote system access points.

The implementation approach meant MMH achieved 100 percent physician adoption of the OpenVista ordering system, an extraordinary achievement that has yielded dramatic anecdotal improvements:

- Medication administration and test result turnaround times went from hours to minutes.
- Medication errors and duplicate tests were dramatically decreased.
- Nursing time shifted from documentation to patient care.
- Nurse overtime decreased.
- Average length of stay for patients decreased.
- Charge capture and claims processing improved.
- Accounts receivable decreased.

With operational improvements achieved, MMH used the system to transform hospital care processes. In 2006, the hospital joined the national 5 Million Lives Project recognized for patient safety initiatives and targeted areas of clinical transformation.

The near complete adoption of Computerized Provider Order Entry (CPOE) functionality by MMH physicians is of crucial importance simply because the issue causes so many healthcare IT projects to fail. Hospitals often spend millions putting IT systems in place that doctors and nurses cannot be convinced to use. Midland avoided this scenario by creating the proper mix of incentive and vision that spurred physicians to make OpenVista a part of their daily routines.

Midland's Journey to Stage 6

The back story for Midland Memorial is both compelling and important for what it says about the potential for clinical transformation in hospitals with limited resources. The first commercial facility to implement Medsphere's OpenVista solution, MMH is a 320-licensed bed hospital operating on two campuses in Midland, Texas. The hospital provides a full range of acute care services to the people of Midland, while serving as a regional referral center for communities throughout west Texas and southeast New Mexico.

In 2002, MMH was under severe financial pressure with approximately sixty days of working capital on hand. With the hospital's existing system (McKesson) approaching end of life and requiring a \$20 million upgrade, Midland CEO Russell Meyers recognized that clinical systems were crucial to cutting costs and improving revenue and quality.

In 2004, MMH selected Medsphere to implement the company's OpenVista electronic healthcare solution for the following reasons:

- OpenVista was less than one-third the cost of most alternatives at about \$6 million over five years.
- OpenVista was offered under a subscription model that MMH could fund through the operational budget.
- The core of OpenVista is proven in the VA system.
- The design of OpenVista is specifically oriented around quality and patient safety.
- The OpenVista core is familiar to a majority of MMH physicians, who trained at the VA.

As demonstrated by the statistics illustrated below and others, the implementation and use of OpenVista to drive clinical transformation has had a dramatic, measurable impact on the care provided by MMH and the lives of the patients the hospital serves.

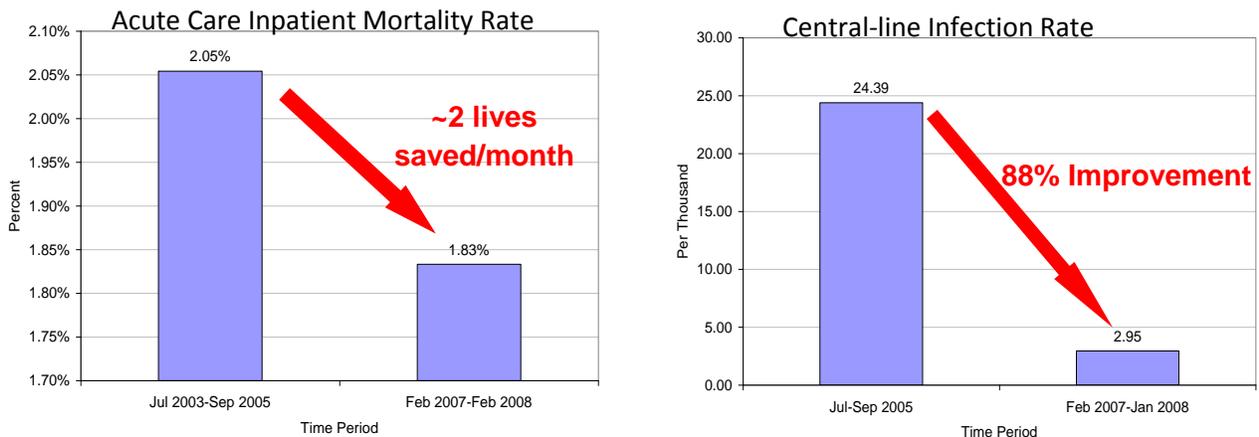


Figure 5: Benefits of EHR adoption at Midland Memorial

No Longer Just Buy v. Build:

Any company that uses software has a buy-versus-build decision to make every time they look to advance their systems. In truth, there are significant drawbacks to both buying something off the shelf and building your own solution, which is why the Open Source model offers an appealing third way: Buy into (philosophically) and collaborate with the Open Source community. This third new model successfully eliminates the drawbacks of the other two.

Buy

Organizations pursue the buy option because it is easier and faster than building custom software. But commercial off-the-shelf (COTS) proprietary software has drawbacks when it comes to buying exactly the right product, customizations, planned obsolescence and fixing urgent bugs.

When buying software, it is often difficult to determine which packages offer the most potential. Marketing literature is often vague and unhelpful, at best, and outright deceptive at worst. With Open Source, users can identify functionality they need and enlist the community of developers and users in creating it.

Once users of proprietary software have selected and installed a particular product, the particulars of the licensing agreement become apparent and potentially troublesome. Can you use the software when a particular server is down? Do you need another license for a hot spare? What if you want to do testing on a separate server? How many users are licensed to use the product? How much more does support cost?

Over time, the questions and issues proliferate. Can you restore the system from backup onto different hardware? Even with a site license, can you run licensed client software from home through an ISP? Open Source users really have to go out of their way to violate the license, which doesn't impact normal duties that involve copying software. This is the real meaning of the word 'free' in the term 'free and open source' (FOSS).

Hopefully, COTS software provides required functionality at a relatively low cost, but even so some functionality is usually lacking. Sometimes simple changes make the application much more suitable for particular tasks. Measured over time, these changes have a real impact on cost, revenue and quality. Open Source means users don't have to write software from scratch, but are still free to make or suggest appropriate changes. While not obligated to share these changes, users may choose to do so to ease the adoption of future releases.

And what if a standard makes your proprietary software obsolete? What if the company engages in planned obsolescence, a natural occurrence when longevity depends on revenue generation? In contrast, a lone programmer with an enduring interest will enable an Open Source application to survive. Even in the unlikely event that an Open Source solution becomes obsolete, users at least have the option of supporting it themselves or hiring a third party to do so. No such option exists with proprietary systems.

Finally, there are the unavoidable software bugs that frequently stall operations. Open Source gives users better and more support options, including the person who maintains the code, the community, a commercial third party, or internal IT resources.

Build

The obvious reason to build your own system is because there is no viable alternative, but the drawbacks of this approach include lack of maintainability and standardization, obsolescence and the challenge of fixing urgent bugs.

In-house software depends on the original developers for enhancement and maintenance. If those people leave, their departure becomes a source of insecurity for the organization. Where Open Source is widely-used, the community is constantly recompiling, using and fixing the application. Everybody knows where up-to-date code is kept and can be downloaded.

There's also the ongoing training cost associated with in-house software. New employees need to be brought up to speed and training services become wholly an internal operation. The scale of Open Source means training resources are frequently available in the community, as are training materials and implementation guides, as it is in the best interests of all to drive adoption and grow the community.

And what if a killer product does come out and makes an internally developed product obsolete? Open Source has an advantage here as well because you can't beat free. The community drives the project to cover areas that need to be addressed, so the chances of being bested by the 'killer app' are minimal.

Summary

A discussion of health IT would be incomplete without at least a mention of the nature of healthcare itself. For decades the industry has been largely left to organize itself according to the dictates of an ineffective marketplace and the collective intelligence of bright people working to improve care. It simply hasn't happened, and arguably the uncoordinated efforts to organize the system have simply expanded its undeniable patchwork nature.

Of course the crazy quilt of healthcare in general is reflected in health IT, making it equally fractured and incoherent. (There are, for example, currently more than 600 EHR companies all trying to cash in on Meaningful Use.) As demonstrated above, the proprietary vendors that dominate the industry have little interest in transparency, interoperability, affordability and collaboration, exactly the factors that enable both high quality healthcare and an effective health IT system.

While the federal government has allotted billion to incentivize the adoption of EHRs, the reality of incentives is that hospitals have taken an implement first, optimize later position that has garnered federal dollars but often slowed down clinical processes and angered clinicians. Many proprietary vendors won't be able to meet Meaningful Use Stage 2 interoperability and transparency requirements by the deadline, which has prompted some professional organizations to suggest moving back the dates; it will probably also prompt some hospitals to rip and replace the EHR they just purchased a few years ago.

Only Open Source offers a legitimate solution for both the obvious challenges healthcare faces today, especially with the involvement of the federal government. Open Source solutions are much less expensive to implement and support, they enable disparate systems and machines to communicate, they free hospitals from slavish contracts, and they encourage cooperation in pursuit of a shared objective. Indeed, the collaboration supported and cultivated by Open Source skews the interests of all parties to the ideological center without draconian mandates. In Open Source health IT, America has the tool to overhaul our broken healthcare system without the federal government taking full control. Ideologically, it is an approach only the most self-interested individuals can oppose.