How Electronic Health Records Are Driving New Storage Challenges For Hospitals

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Executive Summary

In September 2009, Dell commissioned Forrester Consulting to evaluate the impact that electronic health records (EHR) and other clinical information technologies will have on the storage strategies at hospitals and other large healthcare providers. Federal stimulus programs, quality incentives from payers, and competitive pressures in operational efficiency are driving healthcare providers to look more seriously at deploying EHRs — and that is pulling along with it substantial demand for storage for those records.

In conducting in-depth surveys with IT professionals at hospitals and large physician group practices, Forrester found that these institutions faced significant challenges in managing the storage they had as well as in keeping up with the demand for more capacity as data grows. Forrester found that a wide range of storage technologies are deployed, and that users struggle to determine which represent the best fit to accomplish key goals. There are many influencers of these decisions for healthcare users, including internal decision-makers, IT service providers, storage vendors, and most strongly, healthcare application providers. Navigating the wide variety of options and influencers clearly is a challenge. According to this study, buyers are in need of trusted advisors with industry-vertical-specific experience.

Patient Medical Records Finally Go Online

The healthcare sector is in the national spotlight, with initiatives to manage spiraling costs, improve quality, and expand access. Electronic health records (EHR) — moving clinical information from paper to online systems — stands as a critical component of these efforts. The Obama administration’s ARRA economic stimulus package includes more than $36 billion in incentives to promote the adoption of EHRs among hospitals and physician practices with the ambitious goal of having nearly all healthcare providers managing patient information electronically by 2015 (see Figure 1). These health information technology — or HITECH — incentives will provide as much as $64,000 from Medicare and Medicaid beginning in 2011 to each physician that has adopted an EHR. Hospitals can expect between $2 million and $11 million dollars if they qualify in a timely manner.

Providers must not only implement the technology in compliance with standards, but they must also demonstrate “meaningful use” of the technology in the delivery and coordination of care. This is an aggressive goal, and one that policy makers have been pursuing for more than 20 years. While significant barriers remain, this is the most substantial effort to date to move the healthcare sector into the digital age. More than a third of respondents see an impact from the funding either now or over the next two years (see Figure 2). The ability to present clinicians with a complete patient record, share that information securely with other providers, and manage those records over a long period of time will demand highly reliable and responsive storage solutions for all that clinical data — and lots of it.
Figure 1
The US Government Has Put Billions Behind Health Information Technology

The American Recovery And Reinvestment Act
$790 billion

$2B  Office of the National Coordinator (ONC)
$17.2B  Medicare and Medicaid reimbursement to assist providers in adopting EHRs (net after savings)
And some health IT components in:
$4.7B  Federal Broadband and Technology Opportunities Program
$2.5B  U.S. Department of Agriculture’s Distance Learning, Telemedicine, and Broadband Program
$1.1B  AHRQ, NIH, and HHS grants to examine comparative effectiveness
$1.5B  for the community health centers through the Health Resources and Services Administration
A few million more. Indian Health Service, Social Security, Veterans’ Administration

Source: Centers for Medicare & Medicaid Services, Office of Management and Budget

Figure 2
IT Decision-Makers Are Cautiously Optimistic About The Impact Of The Stimulus Package

“What impact do you believe that the federal stimulus spending allocated for healthcare IT, part of the American Recovery and Reinvestment Act (ARRA), will have on your storage budget and planning?”

1 = The incentives will have no impact.
2 = The incentives may have an impact in the next five years.
3 = The incentives will have a direct impact over the next two years.
4 = The incentives have already had an impact.

15%  49%
31%  5%

Base: 175 IT decision-makers at hospitals and group practices

Source: A commissioned study conducted by Forrester Consulting on behalf of Dell, January 2009
The goals and expectations for this healthcare IT initiative are ambitious — and critical to the future quality and affordability of healthcare in the US. The goals go far beyond addressing the operational handling of paper medical records. Applying decision support tools to structured clinical information will dramatically reduce medical errors — especially those related to medication and drug interaction. Ready access to patient history will eliminate unnecessary and redundant tests and procedures. Even greater benefits will result from the sharing of patient information among providers who previously had to request copies of paper records from other providers or work with incomplete medical histories. The creation of regional Health Information Exchanges (HIEs) ensures that physicians have the best available information for diagnosis and treatment, whether it’s an initial consult from a referred specialist or a critical emergency room encounter.

The pressure from policy makers, health insurers, and patients themselves is driving providers to finally move to electronic systems. With limited time between now and the deadlines for compliance, hospitals and physician groups are ramping up their initiatives to implement the infrastructure and systems for clinical information management and sharing. Half of respondents are in the building or planning stages, and even those with active systems will add more departmental modules, clinical decision support engines, and quality reporting tools (see Figure 3).

**Figure 3**

Half Of Respondents Are In The Building And Planning Stages For EHR Systems

```
“At what stage is your organization with regards to adoption of an EHR system?”

<table>
<thead>
<tr>
<th>Status</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Currently have an active EHR system</td>
<td>43%</td>
</tr>
<tr>
<td>Implementing an EHR system</td>
<td>25%</td>
</tr>
<tr>
<td>Planning to implement an EHR system</td>
<td>25%</td>
</tr>
<tr>
<td>No plans to implement</td>
<td>4%</td>
</tr>
<tr>
<td>Don’t know</td>
<td>3%</td>
</tr>
</tbody>
</table>

Base: 175 IT decision-makers at hospitals and group practices

Source: A commissioned study conducted by Forrester Consulting on behalf of Dell, January 2009
```

**Electronic Health Records Are Driving New Storage Challenges**

The growing deployment and utilization of electronic health records and the steady accumulation of patient data at hospitals and physician practices will demand ever-increasing amounts of digital storage. Administrative data, like patient address, billing information, insurance carrier, and claims history, is dwarfed by the details in a patient record.
Lab results, patient vitals, physician orders and notes, and medications demand many more times as much storage and at a much higher level of availability and response time. Billing can wait — urgent care can’t.

Survey respondents cited EHRs and diagnostic imaging systems as the primary sources of growth in storage demand and also pointed to two activities — sharing and retention — as contributing factors (see Figure 4). Email and other back-office systems, often viewed as big drivers for storage, were identified as a factor by fewer than half of providers.

**Figure 4**
EHRs Are The Biggest — And Newest — Drivers For Storage Growth

<table>
<thead>
<tr>
<th>“Which, if any, of the following do you see as driving your future demand for storage?”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronic health records (EHR)</td>
</tr>
<tr>
<td>Diagnostic imaging</td>
</tr>
<tr>
<td>Clinical information sharing</td>
</tr>
<tr>
<td>Compliance with records retention requirement</td>
</tr>
<tr>
<td>Back-office database/email applications</td>
</tr>
<tr>
<td>Decision support and analytics</td>
</tr>
<tr>
<td>Research data</td>
</tr>
<tr>
<td>Other, please specify</td>
</tr>
<tr>
<td>None of the above</td>
</tr>
</tbody>
</table>

Base: 175 IT decision-makers at hospitals and group practices
(multiple responses accepted)

*Source: A commissioned study conducted by Forrester Consulting on behalf of Dell, January 2010*

The rate of storage growth is immense and poses challenges for storage professionals trying to plan for capacity and manage existing systems. Across four categories of clinical and administrative information, healthcare IT professionals expect their storage needs in 2012 to be roughly three-and-a-half times what they are today in 2009. Clinical patient information comes from an increasing wide variety of sources like lab results, physician notes, vitals, meds administration, and cardiac monitoring. As more medical testing and monitoring devices are able to connect to a hospital’s network and feed information directly to an EHR, the level of detail — and size — of the patient medical record will grow. The emergence of genomics and personalized medicine, adding patient genetic information to the record as well, will only fuel more demand for storage. For typical back-office database storage outside of healthcare, growth rates are often reported in the 30% to 40% year-over-year range. However, the respondents to this survey point to far higher growth driven substantially by EHR and medical imaging.

The growth in diagnostic imaging is a particularly large issue. Picture archive and communication systems (PACS) digitally house images from x-ray machines, MRI scans, and other radiology systems that create increasingly high-resolution — often three-dimensional — images in DICOM format. These systems can require multiple petabytes of storage with accelerating rates of growth fueled by more tests (or “studies”) and ever-higher resolutions.
This information has to be at the ready — not only available to physicians within the hospital or group practice, but also shared among other provider institutions as mandated by the stimulus package’s definition of “meaningful use.” More than three-quarters of survey respondents expect that their institutions will increase the level of inbound and outbound exchange of patient data (see Figure 5). These interfaces with regional and national health information exchanges often require a hospital to build a separate clinical data repository to support external access without impacting internal clinical system performance.

**Figure 5**

*Clinical Information Sharing Will Grow Much Faster Than Administrative Data*

<table>
<thead>
<tr>
<th>Information Type</th>
<th>Don’t know</th>
<th>Decrease</th>
<th>Decrease somewhat</th>
<th>Increase somewhat</th>
<th>Increase substantially</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outbound patient medical records (EMR)</td>
<td>6%</td>
<td>14%</td>
<td>30%</td>
<td>48%</td>
<td></td>
</tr>
<tr>
<td>Inbound patient medical records (EMR)</td>
<td>7%</td>
<td>14%</td>
<td>41%</td>
<td>38%</td>
<td></td>
</tr>
<tr>
<td>Outbound diagnostic images (DICOM)</td>
<td>9%</td>
<td>3%</td>
<td>20%</td>
<td>37%</td>
<td>31%</td>
</tr>
<tr>
<td>Inbound diagnostic images (DICOM)</td>
<td>9%</td>
<td>23%</td>
<td>41%</td>
<td>26%</td>
<td></td>
</tr>
<tr>
<td>Inbound document images (FAX, scanned paper)</td>
<td>7%</td>
<td>10%</td>
<td>24%</td>
<td>31%</td>
<td>25%</td>
</tr>
<tr>
<td>Outbound administrative transactions</td>
<td>6%</td>
<td>3%</td>
<td>32%</td>
<td>39%</td>
<td>18%</td>
</tr>
<tr>
<td>Inbound administrative transactions</td>
<td>10%</td>
<td>2%</td>
<td>34%</td>
<td>39%</td>
<td>14%</td>
</tr>
</tbody>
</table>

Base: 175 IT decision-makers at hospitals and group practices (percentages may not total 100 because of rounding)

Source: A commissioned study conducted by Forrester Consulting on behalf of Dell, January 2010

The critical and sensitive nature of the information being managed make availability and data protection top selection factors in buyer’s decision process (see Figure 6). Cost ranked well below these criteria in importance. While simple “cost” may not be a key factor, it’s certainly a problem. When asked about the challenges they face, storage managers are feeling the pain of keeping up with healthcare’s spiraling demand, citing acquisition cost and the runaway growth of capacity requirements as their biggest challenge (see Figure 7).
Beyond these table stakes, hospitals have to wrestle with a number of other significant issues, including:

- **Data migration from older systems.** With so much of the clinical application portfolio in transition to new applications, often consolidating around suites from single vendors, existing patient data must be preserved and moved forward to become part of the patient’s complete record. Even without application changes, data must be moved from system to system as infrastructure ages and is refreshed. As this growing pool of data outlives individual storage systems, the challenge of migrating data as it is being accessed and shared becomes critical. Storage solutions that provide high levels of availability and the ability to perform data migration without disruption are critical to the effective management of this large and growing store of data.

- **Data protection and security.** The ARRA stimulus package contains provisions that significantly stiffen the enforcement and penalties associated with HIPAA privacy and security. And some recent high-profile security incidents at hospitals have further raised the priority level for data security. These imperatives are confounded by the fact that security is not well developed or widely deployed in storage today, nor do the regulations clearly specify technologies or processes to be implemented. This leaves healthcare environments heavily dependent on the recommendations of their trusted vendors to help determine what measures are best suited to a particular situation.
Data archiving and retrieval. Records retention requirements vary by state, but most hospitals will set policies to retain records for 10 years — five for diagnostic imaging. In the case of minors, records are saved at least until they reach majority. As clinical information sharing expands, archived patient data will be retrieved more often, requiring new strategies for tiering and storage management. In spite of these stringent requirements for data archiving, the survey shows that most healthcare facilities depend on tape systems as a technology solution. While tape has long access times and requires lengthy backup windows, the reality for most facilities remains that a low-cost solution that is well understood continues to make sense. Many indicate use of replication; few indicate use of an archive-specific hardware platform or CAS system (see Figure 8).

Efficient utilization and operations. Despite the sector’s commitment to electronic health records and the expected influx of incentive payments, hospitals remain strapped for resources. IT has to look at how to get maximum, long-term benefit from every infrastructure investment and headcount. Healthcare is not unlike other sectors in the budget crunch; all organizations today are trying to improve efficiency to meet growth needs without increasing spending. However, with the extremely high growth rates reported in this survey, the efficiency imperative is that much more urgent as the wastefulness of throwing additional capacity at the problem gets significantly amplified.

Figure 7
Challenges For Storage

“What are your biggest challenges related to storage?”

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acquisition cost control/runaway growth of capacity requirements</td>
<td>54%</td>
</tr>
<tr>
<td>Performance</td>
<td>46%</td>
</tr>
<tr>
<td>Data migration challenges (from older applications to newer technology/application)</td>
<td>42%</td>
</tr>
<tr>
<td>Data protection challenges</td>
<td>41%</td>
</tr>
<tr>
<td>Archival storage and retrieval of data</td>
<td>37%</td>
</tr>
<tr>
<td>Utilization and efficiency issues</td>
<td>35%</td>
</tr>
<tr>
<td>Operating cost control (staff-related)</td>
<td>34%</td>
</tr>
<tr>
<td>Unpredictable growth</td>
<td>34%</td>
</tr>
<tr>
<td>Environment management complexity</td>
<td>17%</td>
</tr>
<tr>
<td>Visibility and reporting</td>
<td>16%</td>
</tr>
<tr>
<td>Time to provision new capacity</td>
<td>16%</td>
</tr>
</tbody>
</table>

Base: 175 IT decision-makers at hospitals and group practices
(multiple responses accepted)

Source: A commissioned study conducted by Forrester Consulting on behalf of Dell, January 2010
The technologies and strategies for management of all this clinical information — from tiny vital-signs entries to very large diagnostic imaging studies — are evolving as well. Hospitals are deploying a rich mix of storage technologies to meet the wide variety of data types and usages of patient data, and healthcare buyers have been quick to tap into new ways to attach, allocate, and manage storage, including Ethernet and Fibre Channel storage-area networks. Eleven percent of the respondents in our survey said that they were using all four of the attachment technologies we asked about: Ethernet SAN, Fibre Channel SAN, file-based NAS, and direct-attached storage. This points either to an interest in increased efficiency through strategic tiering of the storage network, or, more likely, scattered purchases across heterogeneous technologies due to decentralized decision-making.

Despite the strategic importance of storage, most hospitals still take a tactical approach to storage decision-making. Hospitals are missing an opportunity to leverage their storage investments because:

- **Packaged app vendors heavily influence each storage choice.** Healthcare IT buyers look at the whole vendor solution and are likely to tie their storage decisions into each clinical application implementation project instead of looking at their whole storage solution (see Figure 9). This could be seen to say that the dream of a consistent homogeneous SAN for all applications is losing ground to application-specific architectures. Buyers seem to value fit with application over infrastructure consistency.

- **Centralized IT purchasing doesn’t fix siloed storage workloads.** Consolidation of IT infrastructure is a worthy goal for procuring at a low cost, and hospitals have moved to a more aggressive purchasing posture (see Figure 10). But there are still plenty of healthcare providers whose storage strategy is set on an application-by-
application basis. Only 22% are actively trying to efficiently manage storage as an enterprise resource (see Figure 11).

**Figure 9**
Storage Tied To Clinical Solution Providers

“Which external agents influence your choices for storage hardware and software through compatibility, best practices, and recommendations?”

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical application providers (PACS vendors, EHR vendors, etc.)</td>
<td>70%</td>
</tr>
<tr>
<td>Medical hardware providers</td>
<td>61%</td>
</tr>
<tr>
<td>Storage vendors</td>
<td>54%</td>
</tr>
<tr>
<td>Comprehensive IT/system management vendors</td>
<td>47%</td>
</tr>
<tr>
<td>IT service providers</td>
<td>33%</td>
</tr>
<tr>
<td>IT value-added resellers (VARs) or system integrators</td>
<td>33%</td>
</tr>
<tr>
<td>Other</td>
<td>2%</td>
</tr>
</tbody>
</table>

Base: 175 IT decision-makers at hospitals and group practices
(multiple responses accepted)

Source: A commissioned study conducted by Forrester Consulting on behalf of Dell, January, 2010

**Figure 10**
Hospitals Are Adopting An Aggressive Purchasing Posture

“How centralized is IT purchasing in your organization?”

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centralized purchasing with strict adherence to organization infrastructure standards</td>
<td>31%</td>
</tr>
<tr>
<td>Departments make independent purchase decisions</td>
<td>8%</td>
</tr>
<tr>
<td>Centralized decision-making process but independent selections for each application stack</td>
<td>26%</td>
</tr>
<tr>
<td>Centralized purchasing with guidelines for organization infrastructure standards</td>
<td>35%</td>
</tr>
</tbody>
</table>

Base: 175 IT decision-makers at hospitals and group practices

Source: A commissioned study conducted by Forrester Consulting on behalf of Dell, January, 2010
Figure 11
Some Consolidation Of Workloads — Still Plenty Of Siloed Storage

“Which best describes the way you manage storage resources in your organization today?”

- We procure and manage storage on an application-by-application basis. 36%
- We do some consolidation of workloads and manage a limited number of storage technologies. 41%
- We try to manage storage as a single consistent resource across all application and data types 22%
- Don’t know 1%

Base: 175 IT decision-makers at hospitals and group practices

Source: A commissioned study conducted by Forrester Consulting on behalf of Dell, January, 2010
TREAT STORAGE AS A STRATEGIC HEALTHCARE RESOURCE

Clinical information spans many departmental and clinical systems — its role in the reliable storage, retention, delivery, and sharing of patient data is quickly becoming central to quality care. Continual improvements in physical storage density, access times, and transfer rates are being augmented by significant simplification of information storage and retrieval architecture using networking protocols, virtualization, and Web-based data structures. As these storage technologies become more and more integral to “the business,” in healthcare and elsewhere, buyers are changing the way they plan for and manage their storage needs and assess vendor offerings — looking to support “meaningful use” rather than simply technological features. To meet these realities, healthcare providers need to:

• **Manage the organizational complexity.** IT professionals at healthcare providers need to steer their institution toward a more holistic view of storage. A strategic vision of the future portfolio of clinical applications, the amount of storage they will require, the availability, and the archival requirements involved should lay the groundwork for analysis that shows how unsustainable it is to continue to treat storage in a one-off tactical manner. The shift will require both IT and clinical leaders to value storage as a strategic resource and decouple clinical software decisions from the underlying storage and records management infrastructure. Only when the infrastructure becomes less heterogeneous will efficiency increase and complexity decrease.

• **Manage the technology complexity.** While there are a number of storage technologies available, and news on the way, hospitals simply don’t have the time to be managing multiple storage systems for each application or department. Pick a short handful of storage technologies that provide the flexibility, standards, manageability, and growth potential to meet healthcare’s challenge for the next 10 years. Key on the shortlist will be vendors that not only have the right offerings, but that also have a keen understanding of those industry challenges and work together with customers to overcome them.

“Our storage vendor has been very supportive of our strategy to create a single, virtualized storage resource that’s used by nearly all of our clinical applications. That’s helped us manage costs, improve reliability, and quickly take advantage of the best technologies as they become available with minimal impact on the individual clinical systems.”

• **Focus on the outcomes.** The healthcare sector itself is trying to transform from a business model that pays for procedures to one that pays for good patient outcomes. The same should hold true for storage decisions. Pure performance specifications like cost per gigabyte, transfer rates, or access times don’t address the complexity of a hospital’s overall needs for managing patient records.
Appendix A: Methodology

In this study, Forrester conducted an online survey of 175 IT decision-makers at hospitals and large physician groups (more than 20 physicians) in North America to evaluate the impact of electronic medical records trends on storage technology adoption. Survey participants included decision-makers in IT with the title of manager or higher. Forty-two percent of respondents were the seniormost decision-maker in IT — with titles like CIO, VP-IT, or Mgr IT. Questions provided to the participants asked about their respective organization’s activities and plans regarding electronic medical records implementation and infrastructure for online storage of records. Forrester also conducted two qualitative interviews to further understand the responses within the quantitative survey. The study began in August 2009 and was completed in August 2009.

Appendix B: Supplemental Material

Related Forrester Research

Appendix C: Demographics/Data

Figure 12
Type Of Business

“Which of the following best describes your primary type of business?”

Healthcare and life sciences, 91%
Government (federal, state, local), 8%

Base: 175 IT decision-makers at hospitals and group practices

Source: A commissioned study conducted by Forrester Consulting on behalf of Dell, January 2010
Figure 13
Types Of Organization

“Which of the following best describes the organization you work for?”

- Major medical centers: 35%
- Large medical practices (50 and more doctors): 20%
- Community or government hospitals, 27%
- Medium-sized medical practices (21 to 50 doctors): 13%
- Diagnostic centers offering CT, MRI, x-ray, ultrasound services, 5%

Base: 175 IT decision-makers at hospitals and group practices
Source: A commissioned study conducted by Forrester Consulting on behalf of Dell, January, 2010

Figure 14
Respondent Roles

“Which of the following most closely describes your role?”

- VP/director/manager of IT: 58%
- Seniormost decision-maker in IT (CIO, VP-IT, Dir of IT): 42%

Base: 175 IT decision-makers at hospitals and group practices
Source: A commissioned study conducted by Forrester Consulting on behalf of Dell, January, 2010
Figure 15
Respondent Revenues

“Approximately what is your institution’s annual revenue?”

- Less than $499 million: 36%
- $500 million to $999 million: 30%
- $1 billion to $2.49 billion: 14%
- $2.5 billion to $5 billion: 12%
- More than $5 billion: 9%

Base: 175 IT decision-makers at hospitals and group practices
(percentages do not total 100 because of rounding)

Source: A commissioned study conducted by Forrester Consulting on behalf of Dell, January 2010