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The Healthcare Environment Snapshot

Traditionally, the implementation of Information Technology in the healthcare industry has been a reactive process. The process of delivering healthcare is a physical, personal procedure; therefore, lack of IT adoption is not unusual. The first Hospital Information Systems (HIS) software were installed due to the need for insurance companies to track structured data elements such as demographics and insurance details. These structured data elements were necessary to generate accurate payments throughout the healthcare enterprise. The patient would be tracked through the facility from the admission, to schedule, order, transfer, and discharge systems digitally. At that time, that type of implementation showed the limited extent of influence by the IT infrastructure. A strategic enterprise view of healthcare IT would be some decades away.

Most of the clinical charts and any other clinical notes or procedurally relevant information was paper based while X-rays were film based. As time progressed, new diagnostic technologies in vital signs, imaging, and other test procedures began appearing into facilities as silos of information. These ‘silos’ comprised of structured and unstructured data, with no connection to other patient information from an IT standpoint. Even within the realm of the structured data world there are interoperability challenges (Ferranti, et al, 2006). The high complexity of standard data formats and system architecture in the clinical imaging world dramatically raises the challenges of integration.

This disconnection of the clinical and demographic worlds was inevitable, given the HIS systems were not developed to deal with this type of clinical procedural information. However, without enterprise service bus or vendor neutral technologies, the information technology landscape became an extremely complex web of crossed and disconnected information islands. From the beginning, a digital chasm has been present as two distinct, disconnected segments emerged. Simultaneous to the structured disconnect another chasm developed in the clinical imaging world and the other in the medical record domain. Both realms tracked patient information, though neither supported any semantic interoperability or relationship to the other.

In recent years, clinical information systems and workflow systems in radiology and lab (CIS/RIS/LIS) for structured data, and procedural-based systems (PACS) for unstructured data, were introduced to departments to solve departmental issues. To better improve their departmental workflow, healthcare staff sought connectivity to the installed (HIS) billing and scheduling systems, thus further adding to the connectivity dilemma. Though these siloed departmental systems were highly effective in their own departmental right, the many interested stakeholders such as clinicians, physicians, insurance companies, genetics companies, research directors, etc., were seeking a more holistic view of the patient.

Thus began the search for the Electronic Health Record. The EMR was heralded as an information system organized in a patient-centered mode. This concept was analogous to an enterprise resource planning (ERP) system where the patient was a work object. This would enable faster, more knowledgeable clinical decision-making. In addition, linkages to the HIS provided more accurate billing and patient workflow from an enterprise perspective. Given the nature of this departmental evolution and the multiple vendors involved, resident clinicians and information technology professionals have faced the dilemma of coalescing and associated issues. During this time, there has been no clear way to connect the dots. In more recent times, the spiraling cost of healthcare has been well documented, evolving from both the duplicity of information and medical errors caused by this disconnected environment. The major challenges with Electronic Medical records were twofold; first, its provider-based limitation, and second, the lack of tremendous amounts of unstructured data included in the record. In other words, a large volume of unstructured data in Medical Imaging and other large unstructured data content such as Multimedia and Reports across the 24 Specialties, were not incorporated into the greater digital patient record.

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The ARRA and Patient-Centered World Emerges

Early pioneers in medical informatics research suggested the digital medical record (TMR) was an all-encompassing, cohesive view of the patient to improve clinical decision support and patient outcomes. (Hammond, 1974). Since these early concepts, thought-leaders such as Regenstrief (McDonald, et al. 2005) with the Indiana state-based health information exchanges, laid the foundation and roadmap for the vision of ‘one-patient one-record’.

Many new initiatives such as NHIN/LHIN/CHIN/RHIO and now HIE have been enacted in an effort to deliver this ubiquitous end goal. The underlying philosophy of these initiatives is patient-centered versus departmental- or provider-based, however, the technology landscape remained provider- or departmental-centric until earlier this decade when health information exchanges became a reality.

The American Reinvestment and Recovery Act (ARRA, 2007) clearly mandates the need for a comprehensive, cross-provider patient-centered record. The solution to the problem was to define a process to easily allow interoperability between multiple disparate systems, yet this has not been defined in real terms. Interoperability between these systems would be the cornerstone of the movement towards the Electronic Health Record, which currently being sought by the HHS within the United States federal government. Enterprise electronic medical record vendors are being asked to deliver cross-provider, multi-vendor interoperability as opposed to a provider-based model. Combining structured data with the ability to deliver unstructured content, normally the domain of the medical imaging world, a successful journey for departmental medical imaging is nearly impossible with current technologies.

Given the recent increased focus to patient-centered solutions and the necessity to deliver the longitudinal electronic patient record, new concepts and technologies are required to enable semantic interoperability. These initiatives have led to the emergence of Health Information Exchange vendors, but like the world of electronic medical records, the role of imaging is seen as secondary or impossible.

In recent years, the advent of master patient indexes (MPI) and Health Information Exchanges (HIE) has led to the unprecedented ability to present portable, cross-provider patient records, but only from the structured data perspective as reviewed by (Overhage, Evans, & Marchibroda, 2005). At the same time, across the chasm, the clinical imaging realm has remained siloed in proprietary format across the 24 specialties.

Historically, medical imaging and other unstructured content such as multimedia (MPEG), documents (PDF), and medical images (DICOM), have been ignored or delayed in this HIE arena. To increase physician acceptance of technology, we believe a picture paints a thousand words.

The 24 Specialties Digital Imaging Landscape
Now fueled by the American Recovery and Reinvestment Act (ARRA, 2009), the healthcare market must bridge the chasm between the structured and unstructured data worlds. Structured data elements are found in provider-based HIS / CIS / EMR solutions. Unstructured large-scale data resides in proprietary silos, across the 24 specialties in PACS Multimedia and Reports systems. As with the electronic medical record domain, imaging is faced with the need for an integrated, patient-centered imaging record. Frost and Sullivan in 2006 suggested this concept was the ‘holy grail’ for medical imaging.

The volume of DICOM and Non-DICOM images, physician reports, photos, and information generated across the 24 specialties each year is continuing to increase exponentially. Today, CIOs are required to deliver a cross-provider Electronic Health Record (EHR) that incorporates the entire continuum of patient information. Historically, organizations have consisted of silo-minded, large-scale data archival solutions, notorious for lacking crucial connectivity features. Given this backdrop, healthcare providers face numerous critical decisions as they try to consolidate and integrate all associated large-scale data sets.
The Corporate Enterprise Ethos

TeraMedica is a unique medical information technology company that designs, markets and integrates patient-centered vendor neutral architectures for use by physicians, clinicians and information technology professionals. Its heritage and mission is to provide a vendor-independent, integrated healthcare enterprise in hospitals and multi-facility healthcare organizations. TeraMedica embodies the entire enterprise, from acquisition, to processing, to large-scale distribution and beyond. TeraMedica is a proven solution and was specifically created at the Mayo Clinic, Rochester, Minnesota. This institution is a real-world large-scale IDN clinical situation, with multiple systems, languages, issues and barriers to the achievement of the Electronic Health Record goal. TeraMedica has a corporate ethos to single-mindedly develop solutions that solve the interoperability issues seen in the market today, tomorrow, and in the future. The patient-centered health image exchange is our starting line.

The Health Imaging Exchange Solution

In the imaging domain there has been a phenomena known as enterprise archive that incorporates DICOM medical images across departments. TeraMedica's Health Imaging Exchange (HIE) extends this concept, setting new benchmarks. Traditionally, our Evercore® Clinical Enterprise Suite consolidated and optimized DICOM images and other associated large-scale data sets. Evercore provided one access point for a clinical data repository within the walls of a single provider or IDN. The release of the Health Imaging exchange delivers a vendor neutral:

- Scalable Hybrid Federated / Centralized Image Exchange
- Single point access for all image formats within the 24 specialties
- Cross-Provider Image Access Sharing and Distribution
- Beyond DICOM and IHE interoperability.

The Value Proposition

TeraMedica’s vendor neutral Health Imaging Exchange (HIE) creates value for its customers in a number of ways.

Choice - Best of Breed Subsystems
- Delivering the ability to “plug and play” department systems and storage components.

Control - Physician and IT Acceptance
- Clinical policy engine delivering appropriate service levels by physician type. Ability to standardize on established infrastructure.

Vendor Independence
- Open Standards - No more tight couplings with vendors, no more proprietary formats.

Interoperability - Bridge the EHR/HIE Gap
- Linkage of the currently disparate DICOM, Multimedia world to the HL7 Data World, the missing link in the surge towards the Electronic Health Record.

TeraMedica’s Health Imaging Exchange propagated from the lack of scalability in current IT and PACS architectures. Our Health Imaging Exchange addresses the difficulty dealing with heterogeneous vendor environments for the long-term storage of enterprise image data, as well as short-term growth in the size of datasets generated by the imaging modalities. Intelligent management of these digital assets is a necessity in the healthcare enterprise.

The healthcare enterprise typically has a myriad of vendors serving needs in the areas of HL7, DICOM, Multimedia, Storage and Beyond. The solution must be vendor neutral in all these technical areas and adaptable to the variations that exist in the industry. The system must accomplish its task while staying true to the spirit of the enterprise in terms of performance and scalability, and meet the unique needs of many different types of users. Thus Evercore was born, the ultimate healthcare protocol mediator and digital information asset manager. Whether one or all vendor implementations change around Evercore, from HIS/RIS/CVIS/CIS to PACS to storage subsystems, the Evercore system remains ever core to the enterprise.
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The Value Proposition, continued

TeraMedica’s truly unique Health Imaging Exchange (HIE) bridges the chasm between traditional electronic medical records and PACS systems and delivers a direct connection to MPI’s and Health Information Exchange systems. This unique integration to the resident Health Information Exchange, now fully loaded with clinical images, completes the comprehensive patient record across IDN, State or Nation.

The TeraMedica Solution offers:

- A Customer-Centric Health Imaging Exchange
- Rapid Access to all Patient Images
- A Unique Direct Connection to the Master Patient Index or Health Information Exchange
- One Single Access Point to a Longitudinal Imaging Record
- Standard desktop review tools for Documents and Multimedia
- Zero-Download Embedded Viewer for Bandwidth Optimization
- Programmable Physician-Centric Review and Management Policies
- Seamless Integration to a Patient-Centered Vendor Neutral Architecture

The health imaging exchange solution eliminates the many legacy issues across multiple providers and imaging vendors. This solution provides a cost-effective, seamless integration to an existing health information exchange utilizing a centralized image repository for short term caching or long term management. This simplification of the complex multi-factorial clinical imaging world dramatically reduces interface complexity and therefore TCO. Cost will become an increasingly important component in the health information realm (Dixon, Zafar, & Overhage 2010). The end goal of a comprehensive, cross-provider electronic patient record is possible. Secure access to all unstructured data will further eliminate unnecessary exams and other procedures.

Scalable Technology

Evercore is the first “top-down architected,” institutional or cross-provider (HIE) enterprise-scale, intelligent medical information storage and management information technology of its kind. The current generation of medical image technologies grew out of a “bottom-up architected,” department-level driven need to keep image data on a per modality basis, or to “scale up.”

The Health Imaging Exchange is a unique vendor independent modular solution: Evercore bridges the gap between the Health Information Exchange (HIE), MPI, DICOM and Multimedia world. It provides a vendor independent connection of multiple PACS systems connecting to the EMR or EHR. Evercore’s Smartstore™ is the unprecedented patient-centered clinical policy engine, converting hardware into physician-friendly storage pools across country and state lines. Evercore’s Univision™ is a multi-tiered image distribution system serving the masses or the discreet departments and the required service levels per department.

The Benefits

- Rapid access to patient-centered DICOM, clinical multimedia data and other objects in a cross-provider, patient-centered context.
- Easy Optimization of hospital and ambulatory electronic medical records within health information exchanges.
- Improved data access for each customer, leading to increased physician acceptance and better clinical outcomes.
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Enriched Clinical Data Repository
As Evercore consolidates more pools of information, it applies clinically relevant Smartstore protocols, optimizing a medical IT infrastructure. Evercore then provides vital metadata to the clinical data set for the patient linking to the resident clinical repository for a more comprehensive source of data mining.

Enables Genomics Foundation
In the modern healthcare facility, the degree of accuracy of patient data is under constant scrutiny by various groups in insurance, research, legal and, more recently, genomics programs. Evercore delivers the dataset the CIO needs to develop a comprehensive EHR, enabling the next step in patient care and preventive medicine.

The Future Vision
TeraMedica will continue to focus on the role of interoperability and increased connectivity. We endeavor to normalize multiple languages, straddling arenas currently disconnected. Evercore embodies an intelligent clinical data mart within the greater clinical data warehouse. This foundation technology can be implemented across other large dataset areas in document management and nonstandard imaging devices. Evercore will never waiver from the core clinical ethos of delivering the entire patient record to the physicians and clinicians of the world. Cross-provider enterprise access is a hallmark of the solution leading to the development of the SOA-based Health Imaging Exchange and underlying components.

Horizon One
• Clinical Imaging Platform

Horizon Two
• Clinical DSS and Workflow Engine

Horizon Three
• Lifesciences Object Platform

Evercore is committed to deliver unstructured data to the Electronic Health Record by region or (HIE)/(LHII), by nation (NHII), and finally on a global basis. The central vision is to deliver a more comprehensive dataset to the resident clinical data repository. Once the CDR has a richly indexed longitudinal EHR, it can then be coupled with genetic profiles of the patient. This makes the healthcare provider able to enact a new form of medicine—proactive personalized healthcare. Evercore will continue to build on its strong foundation of incorporating and intelligently managing other objects of interest to the new age physician. The end goal of Evercore is to ensure the clinical has access to all pertinent existing information anywhere, anytime in order to make fast, accurate decisions.

“We live in a new world, and we need new, innovative thinking to create a seamless system, without boundaries, where we can exchange data across different sites of care, to create a single complete picture of what happens to the patient,” Hammond said. “This is an exciting time.” (Hammond, 2010)
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References


7. KLAS Enterprise Imaging Landscape Report 2009