Event Management to Improve Patient Safety, Quality and Efficiency
Michael McNeal President CEO Emergin, Mike Harmon Emergin Director Strategic
Alliances

Abstract - Healthcare organizations have cycled through a number of different approaches to architectures, designs and integration strategies. The tendency is to focus on new products, but little focus is spent on event-driven architectures which coincidentally has the most impact on patient safety. This lack of focus results in diseconomy of complexity because systems and functions begin to overlap and no IT governance is established, leading to operational inefficiencies, loss in staff productivity and delayed decision-making. If healthcare organizations do not begin to build an overlying IT blueprint, systems deployment will begin to spiral beyond control and will not be recoverable without a master technology plan.

I. Introduction

Healthcare organizations have cycled through a number of different approaches to architectures, designs and integration strategies. The tendency is to focus on new products, but little focus is spent on event-driven architectures which coincidentally has the most impact on patient safety. This lack of focus results in diseconomy of complexity because systems and functions begin to overlap and no IT governance is established, leading to operational inefficiencies, loss in staff productivity and delayed decision-making. If healthcare organizations do not begin to build an overlying IT blueprint, systems deployment will begin to spiral beyond control and will not be recoverable without a master technology plan.

Many of today's healthcare organizations are challenged with understanding what it takes to optimize best-of-breed systems. Over 80% of effort is spent implementing systems, either through custom integration or configuration. By developing a master technology plan, the plan enables enterprise staff productivity and decision-making. While system architectures pose some challenges, they also offer the short- and long-term opportunity to achieve costs savings, process improvement, revenue and competitive gain, and customer loyalty and retention. But like every technology, system connectivity demands both technical and organizational learning.

More than ever, healthcare organizations are striving to improve operational efficiencies, staff productivity and decision-making. While system architectures pose some challenges, they also offer the short- and long-term opportunity to achieve costs savings, process improvement, revenue and competitive gain, and customer loyalty and retention. But like every technology, system connectivity demands both technical and organizational learning.

II. 5 Steps to an Integrated Healthcare Enterprise

a. Establish IT Key Performance Indicators

The first step toward an IT strategy is to determine Key Performance Indicators (KPIs) that define IT-influenced goals and objectives for an organization. Typically, a healthcare organization's goals are driven by compliance measurements set by regulatory bodies such as JCAHO, ECRI, Leapfrog or Press-Ganey. However, healthcare organizations can create their own IT-influenced KPIs on three levels–organizational, departmental and individual. Organizational KPIs apply to the values, mission and vision of a healthcare organization. Departmental KPIs concentrate on patient satisfaction, patient safety and operational performance. And individual KPIs may set metrics for response times to specific tasks to improve patient intimacy. Examples of quantifiable goals that correlate to an IT strategy are provided below.

Example Organizational KPI's
• Increase employee satisfaction rating 3 points over the same period last year by reducing repetitive job tasks and automating workflow
• Reduce annual employee turnover from 17% to less than 10%
• Increase Press-Ganey Scores from 3.2 to 4 within 6 months
• Increase reimbursements and profits by 5% in the next year
• Implement an operating system that standardizes, harmonizes and integrates multi-vendor systems within 3 years
• Implement enterprise-wide dashboards and score cards (for error detection, alarm/alert rates, staff: patient ratio optimization, application/network QoS)

Example Departmental KPI's
• Reduce total monthly patient incidents by 33% by adding preventative measures of care using analytics, connectivity and traceability
• Implement safeguards to reduce measurable medical and communication errors by 15% in 6 months
• Provide patients with a quieter, safer and media-rich environment (need specific measurement)
• Increase patient throughput by 10% in the ER/OR within 6 months

Example Individual KPI's
• Respond to life-threatening alarms within two minutes
• Submit ideas to continuously improve safe practices and reduce errors Healthcare organizations should seek solutions that drive toward their organizational, departmental and individual KPIs. Metrics play a key role in evaluating the success of corrective actions, and an operating system with dashboards and score cards can help healthcare organizations monitor processes and measure performance against objectives.

b. IT Governance
The second step is to create an IT Governance, or a structure of relationships and processes directing and controlling the balance of risk versus return over IT and its processes. Key stakeholders include the Executive Team, Quality Team, IT Architect, IT Committee and IT Project Manager(s), all of whom collectively oversee the quality and complexity of information systems solutions. IT Governance establishes organizational structure and defines how each business unit, or department, interacts with each other. Within healthcare organizations, IT Governance breaks down departmental silos and introduces economies of scale by mandating teamwork, which is required for peak performance. Integrated Healthcare Enterprise.

The Executive Team creates the overall governance for the healthcare organization. These individuals help to establish the organizational culture, values, mission and vision. The Executive Team provides operational guidance and financial due diligence to ensure ongoing sustainability. It is critical for leaders to drive a performance-based culture to ensure that ongoing focus is on patient safety and quality of care.

An IT Architect creates and manages the Master Plan. The Master Plan includes a short-and long-term IT strategy for choosing, implementing and supporting IT systems. An IT Architect creates a holistic service-oriented architecture for defining master records, integrating multi-vendor components, reducing repetitive job tasks and automating workflow.

The IT Committee is comprised of individuals from business units such as clinical, information services, facilities management and communications. These individuals provide real-world experience and help in the ergonomic design and selection of new technologies.

The Quality Team consists of risk and quality managers that provide guidance on safety and quality within and outside of the healthcare organization. These individuals participate in patient investigations to conduct a Root Cause Analysis (RCA) to detect errors and omissions in the patient care delivery process.

c. IT Standardization (process)

The third step is to create IT Standardization which defines the processes and standard operating procedures for IT systems.

The result is to identify standard IT nomenclature that is transferable from one department to another and one person to another. Although individuals in the organization will need only certain domain knowledge, defining consistent standards across all domains will enable the distribution of information and promote flexible allocation of staff and equipment in the future.

Domains
• Clinical
• Information Systems
• Financial/Human Resources
• Facilities Management
• Communications
IT Components in a Standardized Model
(See Exhibit 1.1)
• Operating System ("Hub"). The integration engine is the hub for all information flow and establishes the standards for integration across the healthcare enterprise. • Gateways ("Conduits"). Gateways are conduits between two disparate systems (example)
• Product Lines ("Spokes"). Product lines are spokes such as business processes or communication systems (example).
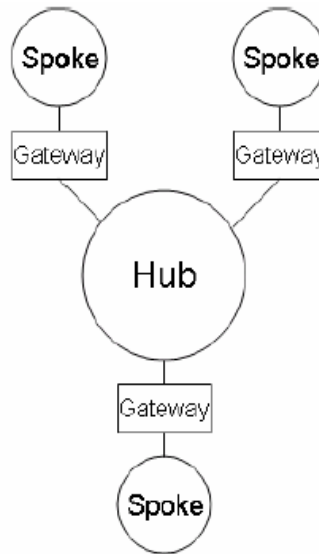

Exhibit 1.1

In a hub-and-spoke architecture, product lines are also referred to as foreign systems. Each foreign system has its own language and dialect, so it is important to establish some rules of governance for these non-conforming systems. In order to harmonize disparate systems, the hub converts the non-standard data from a foreign system into a standard format. There are several considerations for creating standard operating procedures in an IT environment. Below are some of the areas for consideration:
• Master Record Sources/Record Formats
• Vocabulary/Abbreviations
• Integration Profiles
• Alarm Definitions
• Vendors, Applications, App Type and Version

- Device Assignment Policy
- Importing, Exporting and Synchronization
- Lo/Unlock Records
- Security Policies

d. IT Architecture (Technologies)

Often times, healthcare organizations solicit RFPs for product lines including nurse call, patient monitoring, infusion pumps and CPOE. This approach results in millions of dollars of additional expense to healthcare organizations because data is fragmented, components are repurchased and job tasks are duplicated.

For this reason, the fourth step is to create an IT Architecture that illustrates the domains, operating system, gateways and product lines. When the IT Architecture has been created, a healthcare organization can establish an IT strategy for integrating legacy systems and strategically selecting new product lines using a service-oriented architecture, as illustrated in Exhibit 1.1.
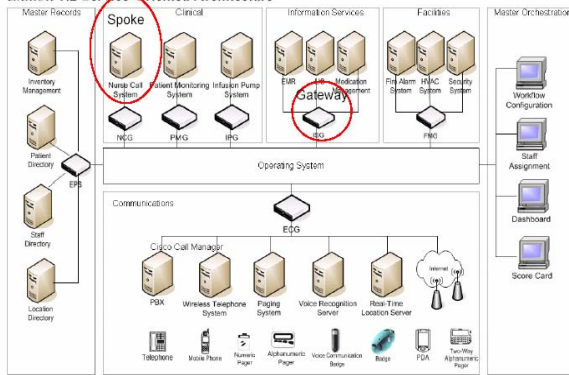

Exhibit 1.2

A service-oriented architecture identifies core components in an enterprise and reduces, if not eliminates, duplicate technologies and repetitive job tasks.

Healthcare organizations should start evaluating the operating system first, then evaluate gateways and product lines based on their ability to follow some level of conformity. This approach to IT decisions will result in workflow improvements to respond to
challenges across the healthcare enterprise, inclusive of clinical, information services, facilities management and communications.

Additionally, each clinical system has its own staff assignment and management report capabilities, so a nurse has to enter information in two or more systems. The additional data entry results in errors and omissions. The management reports are fragmented leading to less than optimal information to make future clinical decisions. Some of the product lines include:
- Nurse Call
- Patient Monitoring

- Ventilators
- Infusion Pumps
- Pulse Oximeters

One of the major challenges facing the Information Systems department is the amount of applications running in the department. Some of the product lines include:
- Bed Management System
- Computerized Physician Order Entry (CPOE)
- Emergency Department Information System (EDIS)
- E-mail
- Electronic Medical Record (EMR)
- Help Desk
- Lab Information System
- Network Management System
- Nurse Scheduling System
- Radiology Information System

The financial management and human resources runs the core operations of the healthcare organization. Some of the product lines include:

- Electronic Health Record (EHR)
- Accounting/Finance
- Inventory
- Human Resources

One of the major challenges facing the Facilities Management department is building automation. Some of the product lines include:

- Blood Bank
- Fire Alarms
- HVAC Units
- Pneumatic Tubes
- Security Systems

There is data and voice convergence occurring in the healthcare enterprise. There is also convergence between private and public communication networks, making the possibility of anywhere communications a reality using dual-mode phones. Healthcare organizations are seeking the 'Swiss Army Knife' – a multi-purpose, all-in-one device that eliminates the tool belt. Device technologies are emerging to provide this capability. Some of the product lines include:

- PBX/Wireless Telephone System
- Paging System
- Voice Recognition Server
- Paging Service Provider
- Cellular Service Provider
- Location-Based Services (IR, RFID, RFLS)

e. IT Blueprint

The fifth step is to develop an IT Blueprint that involves an analysis of existing workflow processes and product lines ("legacy systems"). Workflow processes are evaluated by interviewing department managers and staff members – learning from the trenches what does and doesn't work in their day-to-day environment. An infrastructure profile can identify technologies that are in use today and how these product lines can be optimized to improve workflow. Amazingly, healthcare organizations purchase duplicate technologies because departments don't communicate with each other. If healthcare organizations spend more time identifying an IT architect, creating a master inventory of technologies and defining an IT committee for new purchases, the net result could be millions of dollars per year saved by avoiding unnecessary purchases.

III. William Beaumont Case Study

a. Challenge
William Beaumont Hospital was seeking a plug-and-play integration environment that enabled the hospital to select any combination of best-of-breed systems. The proliferation of discrete applications had led to operational inefficiencies and losses in staff productivity. Unable to predict the technology of the future, William Beaumont Hospital wanted to create an agile, adaptable and future-ready environment. This new, innovative approach would drive standardization, vendor conformance and operational efficiencies. As systems were connected, it would become much easier to automate workflow, reduce errors and omissions, and enhance patient safety.

b. Solution
William Beaumont Hospital had integrated a number of best-of-breed systems, including the Dukane ProCare 6000 Nurse Call, Rauland Responder IV Nurse Call, Philips Medical Patient Monitoring and SpectraLink Wireless Telephones with the Emergin gateways. But over time, William Beaumont Hospital realized that there was no IT governance for all of the best-of-breed systems. Each manufacturer was introducing their own strategy and application-specific functions, but these visions fell short of what William Beaumont Hospital was trying to accomplish – a global, holistic integration plan across the healthcare enterprise.

As a result, William Beaumont Hospital selected the Event Management Solution, powered by Emergin, to create an IT blueprint that drives standardization across the healthcare enterprise. The solution would drive vendor conformance and establish lines of demarcation for clinical systems, non-clinical systems and communication systems. The Event Management Platform acts as a "hub" at William Beaumont Hospital and manage all of the various "spokes" to create a hub-and-spoke architecture that minimizes workflow errors, job duplication and technology cost overruns.

c. Results
Decision Support Tools
- Standard operating procedures for assignments and white board on an enterprise basis, not based on individual applications
- Score Cards to monitor progress for every alarm condition to establish a comprehensive root cause analysis transcript
- Dashboards to measure performance across all best-of-breed systems, no more disjointed information silos
- Outcome advantages
- Estimated 20% reduction in patient response times; elimination of steps from patient request to care delivery, resulting in improved patient and employee satisfaction scores.
- Ability to integrate more clinical systems to assure proper response for the appropriate caregiver in a timely manner.

IV. Conclusion

IT organizations that start now can optimize their operations by strategically planning for and implementing event-driven architectures throughout the enterprise. The task should not be daunting. Organizations can start with a single business unit, and eventually roll out to the entire enterprise. By properly planning event-driven initiatives, your organization will realize improved response time to time-sensitive events, in addition gain almost instant access to decision support metrics that will create a culture of safety, quality and efficiency throughout your healthcare continuum, improving patient and employee satisfaction.