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Hype Cycle for Healthcare Provider Technologies and Standards, 2013

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This Hype Cycle is a key input for healthcare delivery organization IT leaders and strategists when assessing the value of important and emerging technologies and standards to improve care and remain competitive and compliant in a dynamic and demanding healthcare provider marketplace.

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What You Need to Know

In general, Gartner Hype Cycles enable IT leadership, strategists and technology planners to compare their understanding of a technology's evolution against Gartner's analysis of the technology's maturity and value, and to decide whether or when to invest in a technology. If an enterprise invests in a technology too soon, it could suffer unnecessarily through the difficult lessons of deploying an immature technology. If it delays action for too long, it could jeopardize its mission and become less competitive.

The Hype Cycle curve consists of two curves — two distinct stages of upward trajectory or increasing hype. The first stage is the dramatic buildup of hype that leads to the Peak of Inflated Expectations, and the second is the more gradual buildup that leads to the Slope of Enlightenment. The first rise in hype is the interest and excitement that accompany a technology when it is first described, discussed and promoted in the media. The second stage begins with real adoption as a technology gradually ascends the Slope of Enlightenment. Combining the two curves — one based on excitement and hype, and the other based on engineering and business maturity, and customer experience — yields the whole of the Hype Cycle.

The core message of the Hype Cycle is that organizations should not invest in a technology just because it is being hyped, nor should they ignore a technology just because it did not live up to early expectations. Rather, they should be selectively aggressive and move early with technologies that are potentially beneficial to their businesses. The Hype Cycle is also useful in identifying technologies for which the hype has abated and value has been demonstrated.

This Hype Cycle is one of three healthcare provider Hype Cycles for 2013 that tracks IT advances that are of particular interest and significance to the healthcare delivery organization (HDO). This Hype Cycle tracks important healthcare provider technologies and standards that range from the embryonic, like the Fast Healthcare Interoperability Resources (FHIR) Health Level Seven (HL7) standard, to emerging ones such as direct messaging and enterprise file synchronization and sharing, to the more mainstream, such as enterprise content management and medical device connectivity. The "Hype Cycle for Healthcare Provider Applications, Analytics and Systems, 2013" tracks innovative and next-generation applications to improve care quality, improve operational efficiency and meet changing health services demand. The "Hype Cycle for Telemedicine, 2013" helps HDO IT leadership sort through the many applications and challenges of the telemedicine, so they can make better decisions when considering their involvement and investment.

Gartner's healthcare provider Hype Cycles work together to identify and analyze the technologies, standards, applications and systems that are part and parcel of the evolving real-time healthcare system (RTHS). The dramatically increasing pace of medical discovery, demands for transparency into HDO quality and safety, and continued concerns about access and pressures on cost all demand that HDOs create a new, agile management paradigm. Gartner has defined the RTHS as an enterprise that competes by using up-to-date information to progressively remove delays to the management and execution of its critical business processes. This includes the strategic use of IT and communications technologies, and the real-time business intelligence necessary to improve patient care and outcomes and balance demand and resources.

For the purposes of this research, we base our analysis on the market penetration and adoption rates for the industrialized countries of the world. Because of the wide variation among countries in the maturity of the various technologies and standards, it is not possible to define a single position that applies across the world. We have, therefore, chosen to position the entries to reflect their status in the most advanced country or region. In cases where there is a significant discrepancy between the positioning of the most advanced country and those of other countries, we have provided an explanation.

The Hype Cycle

This Hype Cycle tracks information technologies and standards that are particular to the healthcare provider, represent a distinct set of vendors, can offer important value and potential impact to an HDO, or are on a different adoption trajectory from those in other industries. Each entry on the Hype Cycle provides a definition of the technology, a justification for its position and adoption speed, and user advice. In addition, a benefit rating and an assessment of the technology's market penetration and relative maturity are provided. These attributes serve to position the technology or standard on the Hype Cycle, as well as provide direct input into the associated Priority Matrix.

Gartner's Hype Cycles can be used to answer some basic questions about the information technologies and standards. Early in the Hype Cycle, where the more risky technologies reside, HDOs should ask themselves, "Is there anything here that we could be using, anything whose benefits outweigh the risks, that might differentiate us from our competition? Later in the Hype Cycle — for technologies that have weathered the Trough of Disillusionment — HDOs should ask themselves, "Have we overlooked an important technology that could improve patient care or make the enterprise safer or care more convenient?"

To meet future standards of care, satisfy patient experience expectations and remain strong in competitive markets, HDOs must evolve to RTHSs. HDOs must transform their critical clinical and business processes and enhance their IT and communications infrastructure to operate more collaboratively. To successfully operate in real time, they must expand their use of automation, security, situational awareness, service orientation, interoperability and mobility. This evolution, along with an increased focus on the patient experience and compliance, accounts for the new entrants in this year's Hype Cycle. For the HDO to operate and compete in real time, it will need to adopt many of the technologies, standards and best practices found within the various Hype Cycle phases:

1. **Technology Trigger —** During this phase a breakthrough, public demonstration, product launch or other event generates significant press and industry interest. The Clinical Information Modeling Initiative (CIMI), FHIR, nanomedicine, 3D bioprinting, Blue Button+, voice user interface, C-CDA Release 1 (U.S.) and secure text messaging/healthcare are all included in this phase.

2. **Peak of Inflated Expectations —** This Hype Cycle phase is characterized by overenthusiasm and unrealistic projections, and a flurry of well-publicized activity by technology leaders that results in some successes, but more failures, as the technology is pushed to its limits. The only enterprises making money are conference organizers and magazine publishers. Enterprise file synchronization and sharing, consent management, enterprise fraud and misuse management, master data management, IT GRCM tools, and workflow/business process management (BPM) for care coordination can be found here.

3. **Trough of Disillusionment —** Because the technology does not live up to its overinflated expectations, it rapidly becomes unfashionable. Media interest wanes, except for a few cautionary tales. Continua 2012, Integrating the Healthcare Enterprise (IHE) Patient Care Device (PCD) 2010, unified communications, semantic interoperability/healthcare, legacy decommissioning, direct messaging, health information exchange (HIE), ICD-10 CM (U.S.), end-user experience monitoring, Infobutton R1, GS1 Healthcare (GDSN), desktop virtualization, mobile device management and the vendor-neutral archive make up this phase.

4. **Slope of Enlightenment —** During this phase, focused experimentation and solid hard work by an increasingly diverse range of organizations lead to a true understanding of the technology's applicability, risks and benefits. Commercial, off-the-shelf methodologies and tools ease the development process. Information life cycle management, natural-language processing (NLP), location- and condition-sensing technologies, SNOMED CT, IHE XDS.b, patient portals, enterprise content management, user administration/provisioning, and strong authentication for enterprise access are included in this phase.

5. **Plateau of Productivity —** During this phase, the real-world benefits of the technology are demonstrated and accepted. Tools and methodologies are increasingly stable as they enter their second and third generations, and growing numbers of organizations feel comfortable with the reduced level of risk. A rapid-growth phase of adoption begins with this phase. Approximately 20% of the technology's target audience has adopted or is adopting the technology as it enters the Plateau of Productivity. This year, medical device connectivity is the only entry within this phase.

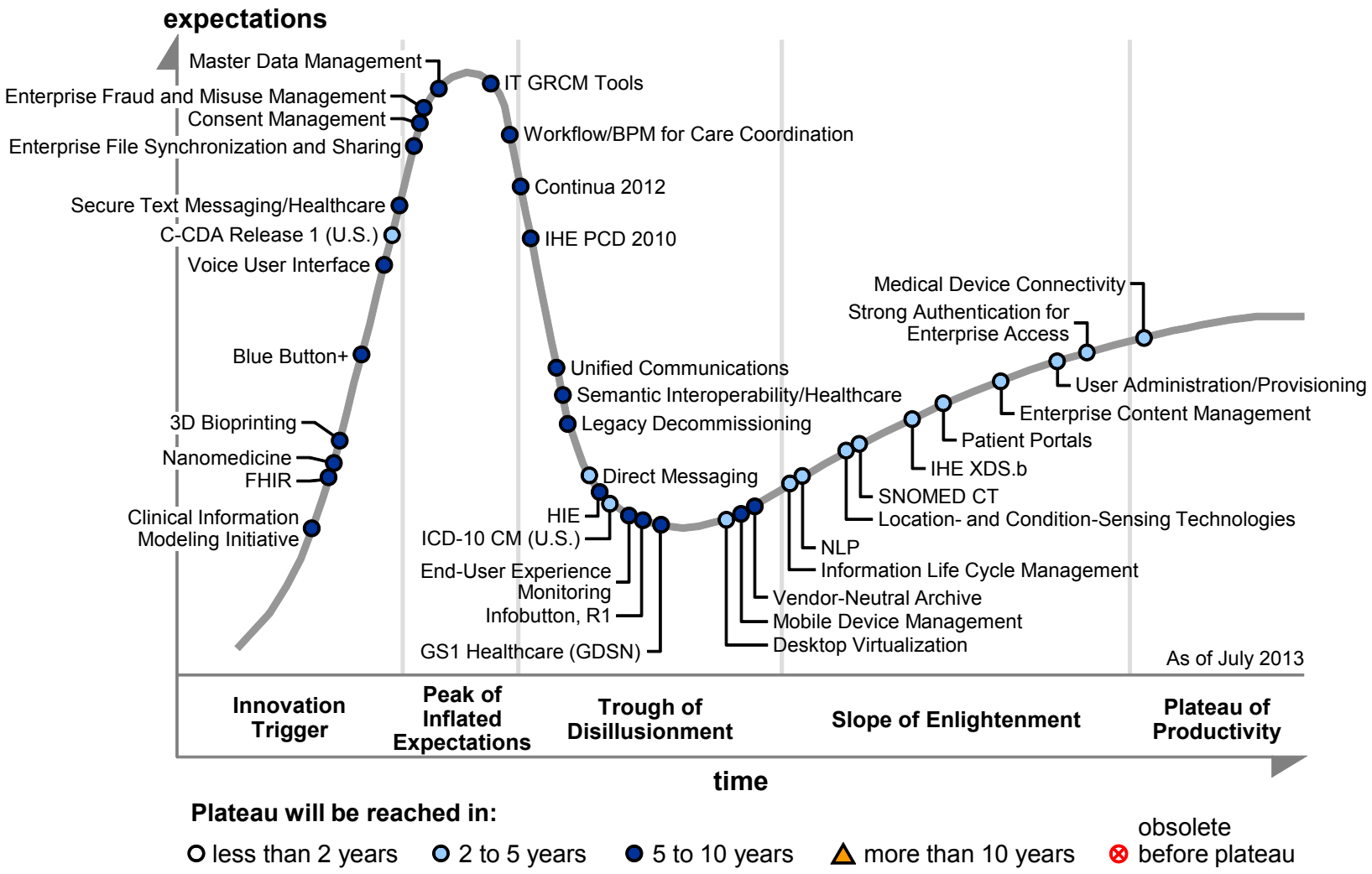
A number of entries on this Hype Cycle did not move off their positions from last year. The installed base for IT governance, risk and compliance management (GRCM) is quite small and limited to mature HDOs that have the process and policy foundations needed to capitalize on the technology. Although little has been done to prevent clinical system users from accessing protected health information (PHI) that is beyond their required need to know, consent management is languishing in place. Gartner has seen little client interest in IHE PCD for standard messages, and for this reason, we will discontinue coverage of IHE PCD 2010 beginning next year. The Clinical Information Modeling Initiative is an ad hoc group of data modelers who are attempting to elicit from clinicians the detailed models of hundreds to thousands of medical ideas. There is still a long way to go

before the impact of CIMI becomes clear. We include it on the Hype Cycle primarily to keep it on the radar screen of academic users and clinical system developers.

New technologies for the 2013 Hype Cycle include:

- Basic Blue Button is a means for consumers to view online and download their own personal health information from electronic health records (EHRs), payers' member portals and personal health records.
- Continua 2012 refers to the Continua Health Alliance's 2012 Design Guidelines. Continua is a global industry alliance that creates open interoperability guidelines for personal connected health-monitoring products and services, provides a logo for products that pass its certification tests, and promotes adoption.
- Enterprise file synchronization and sharing products enable smartphone, media tablet and desktop users to share documents, images, videos and files, and often are deployed as public cloud services.
- FHIR is an HL7 standard in development created for the Web for the interoperability of clinical data.
- Last year's NLP profile has been split to create a new voice user interface entry that addresses voice recognition on keyboardless devices, such as tablets and smartphones, versus the voice recognition capabilities of NLP used to reduce the entry of natural-language text into an EHR.
- Patient portals enable a secure online patient-provider relationship and access to clinical, administrative and educational information, as well as personal health maintenance tools. Patient portals can be stand-alone (composite applications drawing from multiple applications and systems) or tethered to the EHR system.
- Last year's strong authentication for enterprise access and strong authentication for remote access have consolidated under the former. Strong authentication for enterprise access now refers to the various multifactor credential requirements that are used to access IT resources inside and outside the corporate firewall.

Figure 1. Hype Cycle for Healthcare Provider Technologies and Standards, 2013



Source: Gartner (July 2013)

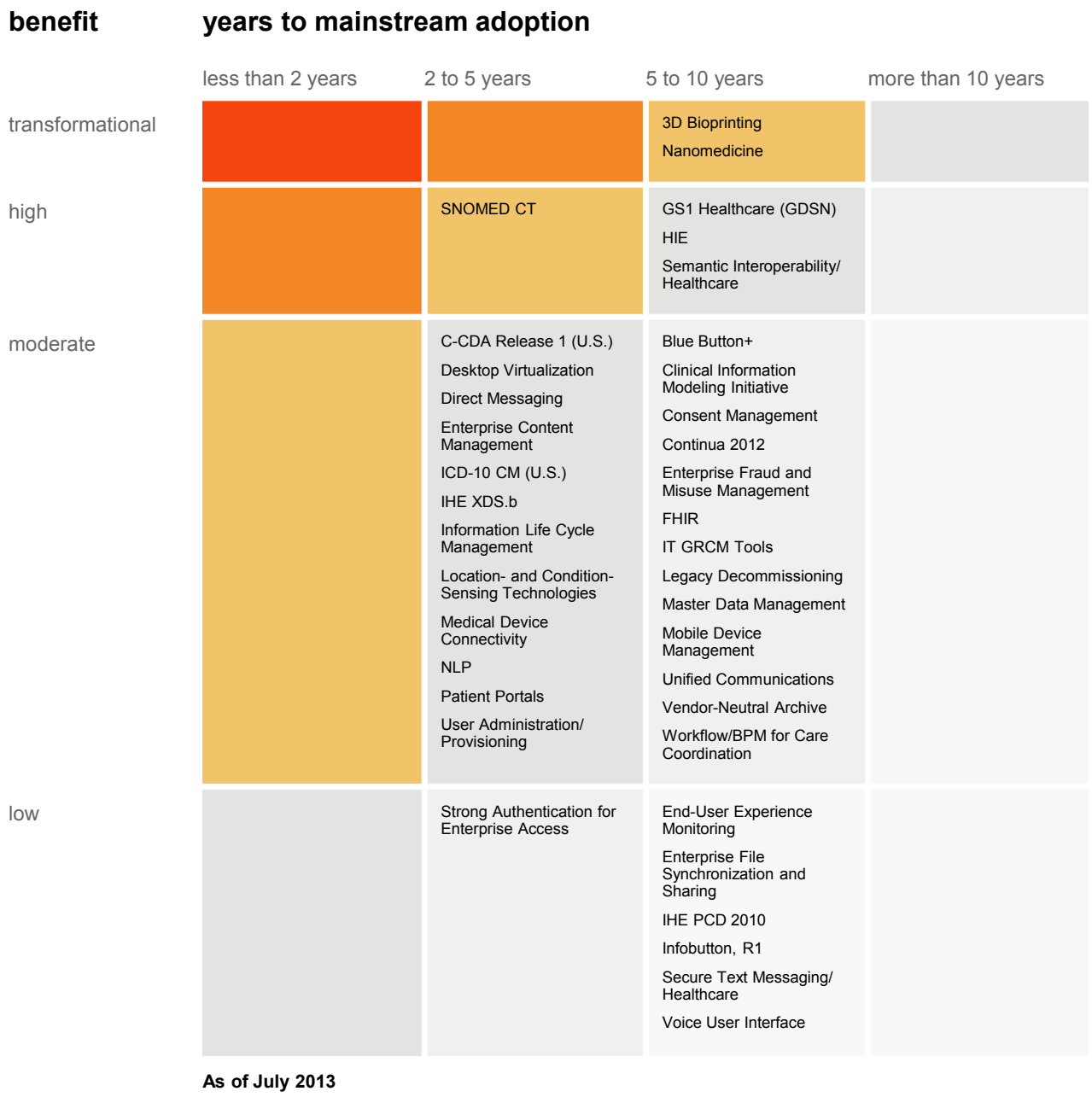
The Priority Matrix

The Priority Matrix is a companion to the Hype Cycle graphic and maps a technology's benefit to its time to maturity. It is generated from the benefit rating and the time to plateau values for each technology. The Priority Matrix provides an easy-to-read format that answers two key questions: (1) How much value will an enterprise get from a particular technology?; and (2) when will the technology be mature enough to deliver that value? Investments that potentially have a high impact and have reached a reasonable level of maturity are located at the top left sections of the Priority Matrix.

Companies that are conservative in their technology adoption (Type C organizations) may limit their focus to this area. Type C organizations may not be prepared to invest in any technologies or standards that have not already passed through the Hype Cycle or, at the very least, are clustered about the Plateau of Productivity. However, these organizations should also invest in technologies that offer substantial benefits in the next two to five years, such as direct messaging, location- and condition-sensing technologies, medical device connectivity and NLP.

Companies that are more aggressive technology adopters (Types A and B) are likely already using technologies that will mature in less than two years. Therefore, they will want to evaluate technologies that are positioned lower and to the right on the Priority Matrix — technologies that will not be in widespread use for two to 10 years or more, and present some risk but may offer a competitive edge. They should now begin to investigate and pilot those technologies that satisfy specific requirements or offer a significant benefit, such as Blue Button+, HIE, semantic interoperability/healthcare, workflow/BPM for care coordination, enterprise file synchronization and sharing, and secure text messaging/healthcare.

Figure 2. Priority Matrix for Healthcare Provider Technologies and Standards, 2013



Source: Gartner (July 2013)

Off the Hype Cycle

This year, we have pruned this Hype Cycle to narrow the focus to more impactful and strategic technologies, and to include less obvious technologies and concepts that are more healthcare-specific. Entries dropped from this year's Hype Cycle include:

- The Bluetooth medical device profile has made limited inroads into the hospital setting through the use of Bluetooth-enabled devices. The strongest potential for growth is in the home health-monitoring market. We will refer to this entry in the future within the Telemedicine Hype Cycle.
- The biggest barrier to digital pathology scanner adoption is the clinical proof of the quality and reliability of the digital slide. Double-blind studies comparing traditional pathology with the results of digital scanning pathology will need to be conducted before the HDOs will adopt these systems, and it will be at least 10 years before this occurs. It is likely that digital pathology scanners will reappear on this Hype Cycle within that time frame, but until then, Gartner believes it is too early to consider adopting these devices.
- The significant cost of distributed antenna system (DAS) gear and installations, combined with difficulties in coordinating carrier support, has caused DAS to languish on the Slope of Enlightenment for some time now. Adoption was expected to increase as smartphones made their way into HDO workflows and as bring your own device (BYOD) policies gained traction. While BYOD has gained traction, DAS adoption among HDOs has not materialized.
- Enterprise public-key infrastructure (PKI) has also been stalled on its climb up the slope for years. Barriers to adoption include confusion about the value proposition, inherent complexity, key management difficulties and high cost. Most HDOs have components of a PKI in place, but no overarching strategy for managing and leveraging them.
- Healthcare-assistive robots are designed to aid patients or caregivers in the home and healthcare environment. They're envisioned to move or navigate in an autonomous or semiautonomous (voice- or remote-controlled) manner, perform tasks, and be able to sense or influence their environments, and do not include more general home or housekeeping robots (like vacuuming or sweeping robots). It was determined that this entry would be more appropriately placed on the "Hype Cycle for Telemedicine, 2013."
- The interactive patient care systems entry has been moved to the "Hype Cycle for Healthcare Provider Applications, Analytics and Systems, 2013" — as it has come to be recognized as more of an application than a technology.
- NwHIN Direct (or Nationwide Health Information Network Direct) is now referred to as the "direct messaging" entry (usually just "direct") and is a means of sending protected health information as structured data, plain text or images, which is more secure than email or fax. It enables pushing data from one covered entity to another, or to a patient's personal health record (PHR).
- As an IT service delivery model, remote hosting is well-understood by HDOs, particularly in North America, with mature offerings available from clinical vendors and third-party providers. Most HDOs are becoming hybrid IT environments where remote hosting, on-premises deployments and the cloud will work together to deliver IT services.
- HDOs now commonly adopt server virtualization to address consolidation efforts, simplify system management, increase availability, improve their disaster recovery posture and satisfy the platform heterogeneity that is common to HDOs.

- Service-oriented architecture (SOA) is an accepted software architecture and programming model, and HDOs appear to be moving steadily toward SOA adoption where it is appropriate. Like other industries, healthcare providers believe that SOA will provide them with the ability to be responsive to new requirements.
- Voice over Internet Protocol (VoIP) is central to the HDO's transformation to an RTHS and has been steadily gaining adoption within the healthcare provider. As existing PBX infrastructures age, HDOs are upgrading to IP telephony. HDOs will continue to be concerned about the effect of VoIP on LAN and WLAN performance, quality of service, and security, despite assurances from vendors — but these have not been significant barriers to adoption.

Three other entries have been dropped, as they became obsolete before reaching the plateau:

- CCR/CCD (U.S.). The CCR is ASTM International's ASTM E2369, a standard designed to enable the sharing of patient summaries among healthcare organizations. The Continuity of Care Document (CCD) is an HL7-based representation of essentially the same content, as well as a set of supporting implementation guides that are aggregated as the U.S. Healthcare Information Technology Standards Panel (HITSP) C32. In the U.S., each standard has had strong advocates, and the competition between the two camps has been notorious. Because of this and decisions made by the U.S. Department of Health and Human Services' Office of the National Coordinator for Health Information Technology (ONC), we marked the CCR/CCD as obsolete before plateau last year and will be tracking Release 1 of the C-CDA as a new technology.
- Sematic Web tools/healthcare are a family of standards that support the Semantic Web standards includes XML, Resource Description Framework (RDF), Web Ontology Language (OWL), and Simple Protocol and RDF Query Language (SPARQL). It was once hoped that these tools would enable a grand vision of the "Web of data" instead of a "Web of documents," but the tools have lingered at slight levels of usage for so long that it does not appear that they will garner widespread use, and last year, we determined this entry was obsolete before reaching the plateau.
- Tablet PCs for healthcare have been eclipsed by interest in the media tablet, and they now represent a smaller number of desktops than ever within the HDO. Adoption rates for tablet PCs have slowed to little more than a trickle. Ultimately, devices that are best-suited for a single task will replace the general-use tablet PCs within healthcare providers.

On the Rise

Clinical Information Modeling Initiative

Analysis By: Wes Rishel

Definition: The Clinical Information Modeling Initiative (CIMI) is an ad hoc group of data modelers that are attempting to elicit from clinicians the detailed models of hundreds to thousands of medical ideas. It plans to make detailed clinical models freely available as unencumbered intellectual property. The models could be used as components to define standard messages or structured

documents, as components of clinical rules, and to automate or facilitate constructing data entry or reporting templates.

Position and Adoption Speed Justification: Detailed clinical models (DCMs) are an important "next step" in semantic interoperability in terms of specific content and breadth of applicability. Currently, European Patients Smart Open Services (epSOS), Australia, the U.S. and other countries are focused on becoming semantically interoperable on the most important basic data, such as problems, medications and allergies, and relying on text for other information. As soon as they reach those goals, they will need to reach out for other clinical ideas, and detailed clinical models will be needed. Little has been done anywhere on the breadth of interoperability (that is, the need to interoperate about things other than simple data items). Whether one is talking about interoperability for clinical decision support rules, detailed order sets, data collection instruments or expressing questions for advanced analytics, developers will find the need for a catalog of DCMs.

Many DCMs have been created in research projects and for specific clinical systems. Indeed, thousands of such models are available as public domain material. There has not, however, been an established consensus form for representing them (or rather there have been multiple consensus forms hence, no real consensus.) Since the publication of our 2012 Hype Cycle, CIMI has worked through its modeling methodology well enough to begin work on trial DCMs.

The impact of CIMI will vary according to its relationship to Health Level Seven (HL7). HL7's Clinical Statements effort is an alternative way of identifying DCMs that is integrated with the HL7 Reference Information Model (RIM). Because the RIM is very abstract, clinical statements do not represent the DCMs in a straightforward manner that is intuitive for clinicians that are not IT specialists. Although HL7 has not been hostile to CIMI, it would be awkward for HL7 to redo RIM-based standards that are beginning to see production use in several countries.

If CIMI is successful in its approach, and if the approach really leverages the use of hundreds to thousands of DCMs already in use, the ultimate impact of its intellectual property could take several forms. It could be the basis for ad hoc agreements among researchers and developers to exchange order sets, clinical rules and input or reporting templates. As almost all countries are trying to enhance the interoperability of independently developed clinical systems, this would help to address interoperability in the definition of system behaviors, a topic that has not, heretofore, been broached. Standards in this area could enable a more robust market for the sale or exchange of content within EHRs and for coordinating content across multiple EHRs.

In some countries, the CIMI intellectual property could be used to create standards for data exchange that would be competitive with HL7.

Finally, if the value of CIMI is proven, HL7 methodologists could work with CIMI to find ways to leverage the collection of many DCMs into a rapid expansion of HL7 coverage.

There is still a long way to go before the impact of CIMI or other detailed clinical modeling efforts becomes clear to the developers and users of EHR systems. We include it on the Hype Cycle primarily to keep it on the radar screen of academic users and other developers of clinical systems. Although we would normally classify a technology such as this as embryonic, the work is directly based on concepts that have been proved in operational systems, so we rate it as early "emerging."

User Advice: HDOs, most of which rely on vendor software, should encourage their vendors to be aware of CIMI, but little other action is possible at this time. HDOs that participate in leading-edge research, such as those funded by Strategic Health IT Advanced Research Projects (SHARP) and Beacon grants, will likely find that they are using DCMs as part of the grant programs.

Business Impact: If healthcare systems are to achieve a future world where clinical knowledge is shared more freely than clinical data is now, it needs a catalog of consensus DCMs. In the very long term, this could substantially change the rate at which healthcare knowledge is discovered, verified and disseminated.

Benefit Rating: Moderate

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: Ocean Informatics; Unusual Visions

Recommended Reading: "Without Profiler-Enforcers, Healthcare IT Standards Cannot Enable Interoperability"

FHIR

Analysis By: Wes Rishel

Definition: Fast Healthcare Interoperability Resources (FHIR, pronounced "Fire") is an HL7 standard in development created for the Web for interoperability of clinical data described at http://wiki.hl7.org/index.php?title=FHIR. By design, it is simpler and more concise than HL7 version 3 standards; shows clinical concepts more directly in its syntax; supports accessing granular clinical data items at a detailed level, rather than in entire messages or documents; and uses an HTTP-based RESTful protocol, where each resource has a predictable URL.

Position and Adoption Speed Justification: FHIR represents the first fresh look at the underlying assumptions of Health Level Seven International (HL7), since HL7 began working on the Reference Information Model (RIM) in 1992. While the underlying notions of messaging and documents that are the basis for its standards continue to be serviceable, they are not easily adapted to the ideas of representational state transfer (RESTful) Web services. RESTful Web services, in turn, are needed for any fundamental innovation in healthcare IT that would connect millions or hundreds of thousands of client applications to servers. An excellent explanation of the benefits of RESTful Web services is available in "Best Practices for RESTful APIs."

Many proponents of FHIR are interested not only because of the promise of supporting very large-scale networks, but because it has the potential to provide more intuitive interface specifications for dealing with programmers in firms that have not invested heavily in understanding the RIM. FHIR is based on the RESTful approach to HTTP and supports multiple data representations, including JavaScript Object Notation (JSON) and XML, using a style that is more concise than the existing

HL7 standards. FHIR is more adaptable to the tooling in use in modern application development environments across industries.

Many of the thought leaders of HL7 throughout the world are enthusiastically supporting this new effort, and many developers of tools for healthcare information exchange are developing support for FHIR, even though it has not yet reached the state of a draft standard for trial use. As with any groundbreaking new approach, it will take a few years before any healthcare delivery organizations (HDOs) that are not self-developers will begin to see purchasing options based on FHIR. It will be three years or more before this approach begins to settle down as a stable standard. When standards based on FHIR are developed, they will likely be applied first in nonregulated interorganization settings where there is a high "fan-in" — that is, the servers are operated by large organizations that are seeking to support hundreds of thousands of clients. This is the sweet spot for the RESTful approach to service-oriented architecture. If they deliver on the promised simplicity, however, they will also no doubt be adopted for new projects not already committed to existing RIM-based standards. The U.S. Office of the National Coordinator for Health Information Technology is considering FHIR-based standards for Stage 3 of the Meaningful Use program.

The simplicity goal for FHIR is well-matched to the goals of CIMI, which is described elsewhere in this report. There is a chance that FHIR-based projects will use CIMI rather than the RIM for detailed clinical models.

User Advice: Self-developers and vendors should consider using FHIR for new projects or products that have the potential to reach the scales discussed here, or where it is important to engage programmers from organizations that are not deeply versed in the HL7 RIM. However, they should not expect the detailed conceptual underpinnings or specifications of FHIR to remain stable. Instead, these organizations should regard current FHIR work as a better way to create project specifications than starting with a blank document.

For now, CIOs and CTOs in most HDOs should avoid purchasing decisions or IT architectures that assume that multiple vendors of clinical systems will implement FHIR consistently or at all. For projects that include highly interactive interfaces where the alternative is to create a whole new specification, they should use FHIR specifications and tools as a starting point for what will essentially be custom specifications and tools.

Business Impact: FHIR could provide a solid basis for basic refactoring of organizational responsibilities in healthcare. For example, it could support multiorganizational reliance on authoritative sources for clinical decision support. At best, however, it would be an enabler. Actually achieving such changes will depend on economic, cultural and legal changes that are more formidable than technology.

Benefit Rating: Moderate

Market Penetration: Less than 1% of target audience

Maturity: Embryonic

Sample Vendors: Mitre

Recommended Reading: "Best Practices for RESTful APIs"

Nanomedicine

Analysis By: Vi Shaffer

Definition: Gartner applies the U.S. National Institutes of Health (NIH) definition of nanomedicine as "an offshoot of nanotechnology that is a highly specific medical intervention at the molecular scale for curing disease or repairing damaged tissues, such as bone, muscle or nerve." At this early stage, the wide range of nanotechnologies and their diagnostic and therapeutic uses are clustered under this umbrella category.

Position and Adoption Speed Justification: Gartner only rarely places medical technology advances on Hype Cycles. We do so when the category is very significant, the connection to information technology advances is tight, and specific important issues for medical informatics professionals arise. Nanomedicine is one of those categories.

The translation of areas of potentially dramatic medical advance, such as genomics 3D bioprinting and nanomedicine — centering on the move from breakthrough research to common application — traverses a pattern that goes from a few experimental uses by highly trained specialists or within clinical research uses to more mainstream adoption over the course of many years and with many trial, regulatory scrutiny and payment approval hurdles to leap.

For nanomedicine, Gartner defines plateau as more than one use having become a standard medical practice within medication or other therapeutic use categories. Current barriers and investigative/R&D problems specific to nanomedicine include clarifying practical beneficial use cases, regulatory oversight, payment issues, and resolving a host of issues related to manageability, toxicity and the environmental impact of nanoscale materials (one nanometer is one-millionth of a millimeter). NIH, which is providing substantial funding for nanomedicine research, calls it a "monumental challenge" to characterize the molecular components inside cells at a level of precision that leads to re-engineering intracellular complexities.

One of the most notable activities moving the placement of nanomedicine ahead is very substantial new investments from the pharmaceutical industry. For example, in the first five months of 2013, Bind Therapeutics has closed development and commercialization deals with Amgen, AstraZeneca and Pfizer, with estimated total "skin in the game" of more than $1 billion — small potatoes in the high stakes world of drug development, but substantial movement nonetheless.

This year, we have moved time to plateau (noting the above definition of some mainstream use) to reflect the tangible progress toward earliest uses and the confidence conveyed by new pharmaceutical industry investments. Broader penetration and the full promise of nanotech will not be realized anywhere near that short a time frame.

Examples from NIH Nanomedicine Development Centers illustrate the wide range of publicly funded and private commercial R&D underway:

- Tunable quantum dots for medical imaging

- Light-controlled pain reliever for acute and chronic pain
- Optical control of biological function
- Nanoparticle delivery of combination cargos directly to cancer targets
- Reprogramming of cell guidance systems
- Nanoscale imaging of protein aggregates and folding machinery to treat disease linked to incorrect folding such as Alzheimer's and Parkinson's

User Advice: Expect new regulatory scrutiny and policy regarding nanomedicine use. The issue of safety is a global concern that will require regulatory review and new policies. In Europe, for example, the Scientific Committee on Emerging and Newly Identified Health Risks has published reports on this. Informed consent, risk assessment, toxicity and human enhancement are just a few of the ethical concerns.

For CIOs, the impact of the potential explosion of nanodata and its new forms, wide variety and speed contribute to data management, IT system performance and storage challenges, as well as its contribution to analysis and big data opportunities and requirements.

Keep your radar on nano and its role in advancing clinical IT's future-generation role as "colleague" and "mentor" of the physician (see "Modifying the Enterprise CPR System Generation Model").

Look for the initial IT support to be in advanced specialized systems or content that relate to the electronic health record (EHR), such as an ancillary system. When support becomes a requirement of EHR systems, it will appear first in the EHRs of leading-edge vendors that have the benefit of close development relationships with academic medical centers.

How to initially and ultimately represent, react to and analyze nanomedicine data will be an important component of adoption. The most analogous experience in modern times is with the field of genomics. Most Generation 3 EHR systems deal with genomics by treating genomic diagnostic and therapeutic procedures as orderable and the informational consequences as text or simply structured reports. This approach enables the incorporation of genomics into existing EHRs without substantial changes to the underlying information models of EHR systems. That is good, because substantial changes to the information model are costly and time-consuming during the development and implementation of revised software.

EHRs could, however, provide more valuable decision support if they were to undertake such revisions to the data model and the concomitant changes to the program code and templates. On one hand, it seems surprising that EHR vendors have not included such changes 15 years after the human genome was first mapped. On the other hand, medical science has taken all of those 15 years to extract from the basic science a substantial body of practice that would require enhanced decision support in EHRs.

Business Impact: Nanomedicine is envisioned to be transformational for medicine. Nanotechnology promises sensitive and extremely accurate tools for in vitro and in vivo diagnostics. In terms of therapy, the most significant impact of nanomedicine is expected to be realized in drug delivery and regenerative medicine. With fulfillment of its broad potential for medical transformation,

nanomedicine would redefine or reinvent a number of the diagnosis and treatment approaches used in medicine today and would require substantial remodeling of the healthcare industry.

The likely impacts will occur area by area over a very long period of time, with providers and payment models adjusting to clusters of innovation.

Benefit Rating: Transformational

Market Penetration: Less than 1% of target audience

Maturity: Embryonic

Sample Vendors: Bind Therapeutics; Liquidia; Selecta Biosciences; Vivonetics

Recommended Reading: "Hype Cycle for Semiconductors and Electronics Technologies, 2012"

"Business Drivers of Technology for Product Manufacturing Industries"

"Emerging Market Analysis: Russia, Capitalizing on IT Innovation"

For information on the NIH Nanomedicine Initiative, see http://commonfund.nih.gov/nanomedicine/index.aspx and "The Ethical Dimensions of Nanomedicine," by Raj Bawa and Summer Johnson, Medical Clinics of North America, Volume 91, Issue 5, Pages 881-887.

3D Bioprinting

Analysis By: Vi Shaffer

Definition: 3D bioprinting is a medical application of 3D printers to produce living tissue and organs. It is a system directed by medical imaging data and software that specifies the design of living tissue and organs, plus the printing device to create a functioning human organ from an individual's own or other cells.

Position and Adoption Speed Justification: Based on R&D and funding progress in the past year, we have nudged this up a bit. However, it is still in the very early stage of the Hype Cycle, requiring substantial further R&D.

While we don't track most medical devices in our healthcare-IT-oriented Hype Cycles, we decided to feature this one, because it so clearly illustrates the potential breakthrough nature of the future fusion of computing, software, hardware and genomics advances. A Washington Post article described the technology as looking like, "the offspring of an Erector set and an inkjet printer. The 'ink' feels like applesauce.... But the goo is made of living cells, and the machine is 'printing' a new body part." Cornell University scientists, for example, are focused on a process that would leverage the capabilities of solid free-form fabrication to create living tissue directly from computer-aided design (CAD) data.

3D bioprinting is one of several innovative tissue-growing approaches being studied by scientists, with interest from entrepreneurs and venture funds. At this formative stage, it could also be overtaken in various targeted domains by other methods using technologies yet to be developed.

Other options being studied include implanting tissue "wafers," injecting stem cells directly into the body, placing cells in a detailed tissue mold and helping organs regenerate themselves by injecting substances to improve the microenvironment for a sick organ.

James Yoo, from the Institute of Regenerative Medicine at Wake Forest University in Winston-Salem, North Carolina, has described a model in which a physician could order up an organ to specifications. His group, with funding from the U.S. Department of Defense, is developing a system that will print skin directly onto burn wounds. The bioprinter has a built-in laser scanner that scans the wound, evaluating the depth and area. The scan is converted into 3D digital images that enable the device to calculate how many layers of skin cells need to be printed on the wound to restore the skin to its original configuration.

In 2013, 3D printing has heated up with media attention and commercial offerings, but 3D bioprinting is marketed mostly as a "must have" for research labs and developers, including academic medical centers and research centers. These are often funded through government grants. It will take an unpredictable course and a long time to move into mainstream tissue and organ production.

Contemporary examples of the state of this industry include:

- Organovo (which calls itself a "three-dimensional biology company") in 2013 created the first functioning "little liver" (see "Cool Vendors in 3D Printing, 2013").
- A Dutch technology — SkinPrint — targets the creation of custom-tailored human skin grafts (for example, for burn victims) with a 3D bioprinter. At the core of SkinPrint's technology is induced pluripotent stem cells (iPSs), important because they can become a diverse range of cells, such as skin cells.
- Researchers at Melbourne's St. Vincent's Hospital and the ARC Centre of Excellence for Electromaterials Science (ACES) are working on developing human organs by building body cells layer by layer using a 3D printer.
- TeVido BioDevices is working to commercialize technology that would allow doctors to use a patient's own fat for print-your-own breast implants.
- Using off-the-shelf printing tools, scientists at Princeton University have created a functional ear that can "hear" radio frequencies far beyond the range of normal human capability.

User Advice: Life science companies and academic medical centers that lead in the investigation of such potential breakthroughs will be participating in or closely following approaches to tissue engineering.

Although this area falls more into the realm of major emerging technologies and life science or biomedical developments, as opposed to "classic" healthcare IT, it illustrates the continuing significance of IT's application to the transformation of medicine. Uses like this are still far in the

future. However, as healthcare delivery organization CIOs get closer to the core, clinical processes of healthcare and to management responsibility over biomedical devices, tracking technology possibilities such as this one helps illustrate the constant potential for dramatic medical innovations. Enabling technologies like 3D bioprinting remind CIOs of the weighty changes in the landscape of medical technologies.

In addition, the detailed organ design, bioprinter device used, and organ production and placement data will no doubt need to be incorporated into the electronic health record (EHR) system of the future, and custom organs would be one more type of computerized order set. This is yet another example of how the volume and variety of data to incorporate into EHR systems and enterprise data warehouses will continue to explode in the years to come.

Business Impact: Bioprinting is one approach to solving a difficult dream for tissue engineers — fulfill tissue engineering designs for human organs, arteries and the like. This is one of the most dramatic examples of the potential breakthroughs that the future fusion of medicine, engineering and IT may hold. The impact of successful commercialization on the business of healthcare and on its definition of services offered will be profound, creating an unprecedented demand for new, custom production services of replacement organs. It would change the business fundamentals of currently lucrative transplant centers, and offer an intriguing service line for medical tourism centers. Moreover, it would create new dilemmas with regard to cost-benefit analysis and medical-necessity approvals for public and private payers and policymakers.

Benefit Rating: Transformational

Market Penetration: Less than 1% of target audience

Maturity: Embryonic

Sample Vendors: Cornell Creative Machines Lab; Organovo; TeVido BioDevices

Recommended Reading: "Emerging Technology Analysis: 3D Printing"

"Cool Vendors in 3D Printing, 2013"

"Predicts 2013: A New Print Paradigm"

"How 3D Printing Disrupts Business and Creates New Opportunities"

Blue Button+

Analysis By: Wes Rishel

Definition: Blue Button+ is an implementation guide, created by the U.S. Office of the National Coordinator for Health Information Technology, to provide standards for the consumer-initiated exchange of structured data among electronic health records (EHRs), claims systems and personal health records.

Position and Adoption Speed Justification: Blue Button+ is often referred to as the Automate Blue Button Initiative (ABBI). It is an extension of basic Blue Button, which is nothing more than a standard icon that a consumer can click to download their personal health information from smart-device apps or portals that support EHR, payers' members and personal health records. The blue button is a service mark registered by the U.S. Department of Veterans Affairs (VA).

Systems that use the Blue Button icon should respond to a click by downloading an ASCII file containing human-readable text that provides a summary of information in context at the time of the click. For example, it might download a patient summary, a visit summary, some patient information from a personal health record or a summary of claims for a member, perhaps with an explanation of benefits. The manner in which the consumer accesses and uses the file is outside the scope of the specifications for basic Blue Button.

Several U.S. federal agencies, including the Department of Defense, Centers for Medicaid and Medicare Services (CMS) and the VA, have implemented basic Blue Button. Numerous health plans have pledged support for Blue Button in response to a request for support from the U.S. Office of Personnel Management, administrator of the Federal Employees Health Benefits Program. Numerous vendors of EHRs and personal health records have begun using, or at least expressed support, for basic Blue Button.

The VA reports hundreds of thousands of Blue Button downloads, indicating interest by veterans in using hand-carried printouts to provide some basic coordination of care where interoperability among EHRs is lacking. Indeed, the underlying spirit of the Blue Button Initiative was to put *something* in the hands of consumers long before progress could be achieved on true interoperability among healthcare delivery organizations (HDOs).

The Blue Button+ implementation guide describes implementation standards, tools and services to go beyond downloading human-readable text files. It includes the following:

- The use of the HL7 Consolidated Clinical Document Architecture (C-CDA) for EHR data to standardize the format of EHR-sourced, structured data.
- Some loose interim recommendations to create a structured specification for claims data.
- Automated push, by which the user of the patient/member portal of an HDO or a health plan could direct the current snapshot of their records to be sent to another application (perhaps their personal health record). The user can also request that updates be sent as they become available until the request is canceled. In theory, the consumer could even request the transfer of information from one EHR to another.
- Automated pull, by which a consumer could initiate such a transfer from the receiving system, rather than the sender.
- Secure mechanisms for transport, identifying and credentialing corresponding systems for pushing and pulling.

As of June 2013, the only content of the Blue Button+ Implementation Guide that is relatively firm is what's included for pushing C-CDA structured documents using the Direct protocol. As it happens, those particular parts of the implementation guide will provide a technical solution to meet the

"view, download and transmit" requirements associated with Stage 2 of the Meaningful Use Incentive Program for EHRs. Although the Meaningful Use regulations do not actually require the use of the standards in the implementation guide, it is hard to achieve interoperability without some common specification. This implementation guide has the benefit of using standards that are necessary to meet other Stage 2 requirements.

Because Blue Button+ is brand new, we have placed it on the rising side of the Hype Cycle. We expect significant progress during 2014 to 2017 — the rollout period for Stage 2 requirements for Meaningful Use. As with any mandate for something new, users will initially target nominal use for compliance.

What happens next is an open question. Fuller acceptance of Blue Button+ will depend on consumers' reactions. Some drivers that would lead the U.S. healthcare industry to expand the use of Blue Button+ beyond nominal compliance include the following:

- Healthcare consumers' increasing awareness of the need to coordinate their own care, combined with systemic failure among healthcare organizations to provide care coordination
- Reduced physician resistance to accepting data that has been touched by patients, presumably through good experience during the time of nominal compliance
- A failure to substantially increase inter-EHR interoperability in pulling patient information, due to HDO reluctance to share data or privacy policies
- A digital signature in the standards that assures clinicians that data from another HDO was not altered as it passed through patient hands

User Advice: CIOs, chief medical information officers (CMIOs) and EHR application managers in U.S. HDOs should minimally press EHR vendors for Blue Button+ functions sufficient to meet Stage 2 view, download and transmit requirements.

After achieving nominal compliance, people in those roles in some HDOs should work with clinicians to find support for using patient-carried data when working with patients who regularly cross HDO boundaries. The HDOs with the most to benefit from leading-edge adoption of Blue Button+ are those that: (1) are in markets where inter-HDO interoperability is not working well; (2) have lines of business where patients are likely to cross HDO boundaries; (3) have heavy concentrations of federal employees; or (4) require a leading-edge posture for raising donation-based funds.

Business Impact: Minimal adoption of Blue Button+ has high business impact for HDOs that need to meet the requirements for Stage 2 of Meaningful Use. Further in the future, it could be instrumental to improving the safety and efficiency of interorganizational transitions of care, although this benefit will not be clear for several years.

Benefit Rating: Moderate

Market Penetration: Less than 1% of target audience

Maturity: Embryonic

Sample Vendors: Humetrix

Voice User Interface

Analysis By: Wes Rishel

Definition: Although speech recognition is often used as an add-on to electronic health records (EHRs) to reduce the entry of natural-language text, here we focus on voice recognition on keyboardless devices, such as many tablets and smartphones as applied to EHR UIs. Because this is a high-interest area with architectural and business challenges, it merits its own entry on the Hype Cycle.

Position and Adoption Speed Justification: Primarily due to the popularity of Nuance's Dragon NaturallySpeaking on Windows client devices, clinicians are comfortable with and frequently demand voice recognition as a condition of accepting EHRs. At the same time, clinicians, as well as many other users of Android and iOS devices, are increasingly getting excellent results using cloud-based voice recognition services from Google and Apple to streamline their use of email, texting, social networking and many other apps. Nothing could be more natural for them than expecting to use voice recognition in clinical apps on keyboardless devices.

Meeting these expectations is not as easy as it might appear, however. Voice recognition technology on keyboardless devices is always provided from the cloud to minimize the battery life and weight of these devices. Voice recognition services targeted at consumers are effective because they work against massive databases of utterances in common usage, but they do not perform well when presented with audio that includes the hundreds of thousands of utterances that are specific to medicine. Clinical users want the convenience of the keyboardless device, but expect the service they received using the client-based Dragon NaturallySpeaking.

There is an additional complication doing voice recognition on keyboardless devices. It is not sufficient to simply use the voice to enter blocks of text. To maintain user satisfaction, it will also be necessary to enable voice for navigating the UI, entering numeric data and selecting from long lists, such as compendia of diagnoses, orderable tests, medications and allergies.

For all these reasons, vendors of EHRs and other clinical systems are turning to healthcare-specific voice recognition vendors with APIs that support UI navigation and long-list selection through cloud services. These APIs compensate for noticeable latency time when using a cloud server. People will accept latency when they are speaking the contents of a paragraph or more before seeing the text. However, vendors do not expect users to tolerate the same latency when working through a documentation template one field at a time.

Two voice-recognition vendors, M*Modal and Nuance, have been working with major EHR vendors to develop the architecture and APIs that will satisfy clinical users. Major EHR vendors have taken the unusual step of customizing their applications to work with the proprietary APIs of these two vendors.

Although several vendors have made substantial progress and have some very early keyboardless users applying this new approach to voice recognition, it is still very early in the Hype Cycle. It is reasonable to expect rough spots in EHR software, as well as in making the architecture secure and responsive.

User Advice: CIOs and chief medical information officers (CMIOs) must manage user expectations carefully, even as clinicians come back from conferences "fired up" about going keyboardless with their favorite smartphone or tablet. Consistently ask these users about actual use in a setting comparable to the HDO. Consider offering NaturallySpeaking on Windows to tablet clients as a temporary stopgap, at least for a few important users.

Recognition accuracy is still an issue with some users and in some settings, so pilot before making a major commitment to voice UI.

Work with users with the consistent viewpoint that keyboardless devices are valuable in specific settings, but understand that it is not true that the world is going wholly keyboardless. The number of situations where keyboardless devices are accepted will expand as vendors and users get more experience with voice recognition.

Business Impact: Ultimately, users will find more convenient workflows as they learn the strengths and limits of voice recognition in keyboardless devices. Some of the more novel workflows may be surprising. Many will provide moderate improvements and marginal efficiencies. However, this technology does not offer opportunities to fundamentally rethink caregiver processes.

Benefit Rating: Low

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Recommended Reading: "Hype Cycle for Human-Computer Interaction, 2013"

C-CDA Release 1 (U.S.)

Analysis By: Wes Rishel

Definition: The HL7 Implementation Guide for CDA Release 2: IHE Health Story Consolidation, Release 1 — US Realm (C-CDA) is a single volume that contains implementation guides for nine types of XML healthcare notes: Continuity of Care Document (CCD)/HITSP C32, Consultation Note, Diagnostic Imaging Reports, Discharge Summary, History and Physical (H&P) Note, Operative Note, Procedure Note, Progress Note and Unstructured Documents. The standard is defined for use in the U.S. It supplants previous stand-alone implementation guides for the document types.

Position and Adoption Speed Justification: For each document type in the C-CDA guide, the entire content can be displayed as text, and with selected content represented in a structured and coded form.

The C-CDA is required for transmitting information to support transitions of care under Stage 2 of the meaningful use incentives for use of an electronic health record (EHR) in the U.S. In this regard, they replace the previous requirement to use the ASTM International continuity of care record (CCR) of a prior version of the HL7 CCD/HITSP C32.

We have positioned this standard early in the Hype Cycle because it is nominally a "version 1 standard," and there is, as of yet, no real-world experience using it. Normally, Gartner would not expect a version 1 healthcare IT standard to achieve at least 20% penetration of a market in five or fewer years. However, this set of implementation guides includes a redo of the CCD, based on experience with implementing it in many projects since it was published in 2010. A second version of a standard, based on experience, has better prospects of widespread implementation than a brand-new standard. Many of the vendors that will bear the brunt of implementing these implementation guides participated in the corrections of the prior specifications that constitute the bulk of the changes in this release. They are very motivated to implement them because their leading-edge customers will be required to use them to meet the certification requirements for Meaningful Use Stage 2 later in 2013.

In addition to the artificial business incentive imposed by the Meaningful Use requirements, healthcare delivery organizations (HDOs) that participate in accountable care arrangements will need to implement the exchange of some structured data for transitions of care when referring patients to skilled nursing facilities and home care. This adds actual business incentives that have been rare when implementing interenterprise interoperability.

User Advice: If the CCR or HITSP C32 is currently in place and satisfactory, continue to use it until driven to change the interface by a business need for more semantic interoperability or the requirements to support transitions of care in Meaningful Use Stage 2. For new projects, go directly to the C-CDA as soon as your vendors offer it as an interface standard.

Business Impact: Care coordination in various forms is a strategic mandate for virtually all HDOs. With increasing interest in accountable care organizations and the patient-centered medical home, the use of standards to enable information sharing across organizations is a significant enabling technology.

Benefit Rating: Moderate

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: Cerner; Epic; Health Level Seven International

Secure Text Messaging/Healthcare

Analysis By: Barry Runyon; Ben Flam

Definition: Text messaging refers to SMS offered by wireless carriers. SMS involves the transmission of short text messages, limited to 160 alphanumeric characters, to and from a mobile phone, fax machine or IP address. SMS is unsecure (clear text), and message delivery is not

guaranteed. Secure texting for healthcare leverages the familiar texting experience and employs cryptographic protocols like Secure Sockets Layer (SSL) for compliance.

Position and Adoption Speed Justification: SMS is the most widely used data application in the world. It is a familiar and routine activity for the vast majority of mobile phone users. Its use within the healthcare delivery organization (HDO) by employees and clinicians is commonplace, although not often formalized or sanctioned in mobile device policy. Many HDO compliance and security professionals have dismissed the enterprise use of SMS because of its unsecure and unreliable technical characteristics. However, as a communications tool, it is useful, simple to use and ubiquitous, and users find these characteristics attractive.

There are strong indications from Gartner inquiries over the past year, from HDOs and vendors alike, that HDOs are beginning to accept the fact that text messaging is commonplace, and they are showing increased interest in incorporating texting into their business and clinical workflows. They now must take steps to ensure it is done in a secure and compliant manner. There is also increasing interest among healthcare providers in using texting, not necessarily secure services, for patient communication — for example, to alert patients about their appointments and test results. The HIPAA Omnibus rule, which took effect 26 March 2013, explicitly permits "in the clear" email with patients, including the transmission of protected health information (PHI — see www.hhs.gov/ocr/privacy/hipaa/faq/health_information_technology/570.html).

User Advice: HDO leadership should not dismiss text messaging out of hand because it is viewed as a consumer tool, but rather, make a conscious decision to use or not use texting, based on HDO leadership's strategic use of mobile assets, alignment with enterprise business goals and an articulated mobile device policy. If text messaging is identified as a viable tool by an HDO for user and clinician communications, steps should be taken to make it reliable, secure and compliant. Existing vendors of secure text messaging products will be tailoring their offerings to the healthcare provider market, and new secure messaging tools and platforms are expected to be introduced during the next year or two — many of the offerings will be cloud-based.

Select a secure texting platform that is as transparent to the user as possible, and will not interfere with the normal transmission or receipt of nonencrypted text messages. A secure text messaging service should work across all major smartphone platforms (Apple, Android, BlackBerry and Windows) or at least those supported by the HDO's mobile device management platform (see "As the Mobility Movement Gains Momentum, Healthcare Delivery Organizations Must Prepare to Adapt"). Select a text messaging platform that offers a directory service that will synchronize with the enterprise directory; offers a browser-based administration and management console; includes a Web client application; can handle images and attachments; and offers provisions for compliance data retention, auditing and reporting requirements. A secure text messaging service should be able to use Wi-Fi or cellular networks seamlessly.

Business Impact: When properly selected and implemented, secure text messaging can facilitate and streamline HDO user and clinician communications using a familiar, simple and ubiquitous tool that has an affordable cost of entry. Secure text messaging is necessary when messages include PHI. HDOs have begun to embrace the "bring your own device" (BYOD) movement as a way to

satisfy end-user mobility requirements, and secure text messaging adoption will benefit. However, BYOD brings with it the need for new governance, security, support and expense approaches.

Benefit Rating: Low

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: 2DigitMedia; CellTrust; Health BI (HealthCollaborate); Imprivata; PerfectServe; Protected Mobility; qliqSoft; Red e App; Santech; TigerText

Recommended Reading: "As the Mobility Movement Gains Momentum, Healthcare Delivery Organizations Must Prepare to Adapt"

"Implement the Right Text-Messaging Platform to Support the Provider and Engage the Patient"

"Top Actions for Healthcare Delivery Organization CIOs, 2013: BYOD by Design"

"Healthcare Reform Driving Cloud Services Providers Toward Maturity"

At the Peak

Enterprise File Synchronization and Sharing

Analysis By: Barry Runyon

Definition: Enterprise file sharing and synchronization (EFSS) products enable smartphone, media tablet and desktop users to share documents, images, videos and files. These products are more often cloud or hybrid services that offer collaboration capabilities and are supported through native applications, file managers and Web browsers on the various client devices.

Position and Adoption Speed Justification: The success of media tablet and smartphone devices within the healthcare delivery organization (HDO) is driving the adoption of these products and services to store and share files across multiple devices. Personal cloud file-sharing services such as Box and WatchDox, often free for nonpremium services, are beginning to show up within the HDO. Bring your own device (BYOD) initiatives are also driving interest in personal cloud file services, enabling a new style of mobile collaboration. HDO IT organizations are beginning to embrace the value proposition but are establishing control by deploying enterprise-class file synchronization and sharing capabilities to enable enhanced mobile collaboration, while minimizing compliance risks. Management and security capabilities, such as password protection, remote wipe, data encryption, containerization, access tracking and reporting, are common with these platforms. Back-end server integration with SharePoint, Active Directory, LDAP and other corporate platforms is available.

Three different EFSS service delivery models are emerging:

1. Pure cloud (for example, Box and YouSendIt). This is preferred by organizations that want a secure alternative to the personal cloud, while preserving the user experience and enhancing mobile collaboration.
2. On-premises (for example, Accellion and GroupLogic). This is preferred by organizations concerned about where the data is stored.
3. Hybrid (for example, Oxygen Cloud). This is preferred by organizations aiming to simplify mobile access to corporate data through the private cloud.

Challenges to adoption include perceived security risks associated with cloud service providers. Despite the general lack of agreement on cloud security standards, healthcare providers will increasingly adopt cloud services that involve protected health information (PHI) to keep pace with the IT requirements necessary to remain competitive in an industry that is under unprecedented pressure to transform itself.

User Advice: HDOs that have introduced BYOD programs should be aware of the growing interest in cloud file-sharing services. Be mindful of the potential compliance and security risks related to cloud use, and limit use to licensed, premium versions of these services. Don't do business with any cloud service provider that will not sign a Health Insurance Portability and Accountability Act (HIPAA) Business Associate Agreement (BAA) or adhere to a regional regulatory counterpart, such as the European Data Protection Directive 95/46/EC.

Business Impact: EFSS will enable greater productivity for mobile workers who must contend with multiple computing devices. HDOs investing in EFSS will enable a more collaborative, real-time workplace, while reducing the inherent security or compliance threats posed by personal cloud file-sharing services.

Benefit Rating: Low

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Box; WatchDox; YouSendIt

Recommended Reading: "MarketScope for Enterprise File Synchronization and Sharing"

"Use These Best Practices to Deploy a Private Enterprise-Class File Sync and Share Service"

"Move From Document Management to Enterprise Content Management"

Consent Management

Analysis By: Barry Runyon

Definition: Consent management is a system, process or set of policies for allowing consumers and patients to determine what health information they are willing to permit their care providers to

access. It enables them to affirm their participation in e-health initiatives — such as patient portals, personal health records (PHRs) or health information exchanges (HIEs) — and to establish privacy preferences to determine who will have access to their protected health information (PHI), for what purpose and under what circumstances.

Position and Adoption Speed Justification: In 2010, the Office of the National Coordinator for Health Information Technology (ONC) convened a Privacy and Security Tiger Team, and consent management was on the agenda. Like Gartner, the Tiger Team recognized that granular consent is still in its early stages, and models for a granular approach need to be carefully considered. In particular, it was concerned that the ability to limit large segments of healthcare information from inclusion in HIE would greatly diminish the usability of the data and, therefore, adoption of HIEs. The ONC proposed that patients should be able to decline to participate in HIE altogether. This approach would address the concerns of patients who prefer not to have their information shared, while ensuring, for those patients who do participate, that healthcare providers will have access to the information necessary to provide quality care.

Consent management demonstrations at the Healthcare Information and Management Systems Society (HIMSS) conferences depict real-world healthcare provider use cases, including clinician-asserted rights, purpose-based access (for example, emergency access), patient-determined privacy preferences and consent directives, and flexible policy management. Examples of consent management are in production within several healthcare delivery organizations (HDOs) in the U.S. (for example, Texas Department of State Health Services, Kaiser Permanente, Department of Veterans Affairs and Brooklyn Health Information Exchange). These implementations are typically based on simple role definitions and actions that are primarily pushing or requesting data. These implementations are to manage consent interorganizationally, rather than within an HDO.

Work is underway through the U.S. Healthcare Information Technology Standards Panel (HITSP) and other standards bodies (Integrating the Healthcare Enterprise [IHE], Health Level Seven [HL7], Organization for the Advancement of Structured Information Standards [OASIS] and Workgroup for Electronic Data Interchange [WEDI]) to implement privacy consent and access control standards for the secure electronic exchange of PHI. Accountable care and patient-centered healthcare movements will drive industry interest in consent management going forward. However, progress to date has been slow and is reflected in this Hype Cycle entry's lack of forward movement over the past year.

User Advice: Consent management supports the dynamic creation, management and enforcement of consumer, organizational and jurisdictional privacy directives. Those involved in privacy, security and compliance within HDOs and HIEs should be thinking about what policies and technical controls are required to manage consent and limit the disclosure of PHI. They need to be asking what kind of consent management systems will be needed in the future to record, and enforce the preferences of their consumers and patients. HDOs will need to make their legacy systems more privacy-aware.

They will need to deal with the complexities and variations in consent-related datasets, formats, definitions and regional differences, so that local systems can apply privacy rules appropriately. HDOs should capture consumer preferences (in the form of consent directives) using consent management tools suitable for automation, and apply those preferences systemwide. Increase

patient safety and mitigate medical fraud by allowing authorized healthcare providers to access PHI through overrides when necessary.

Consent management tools are still emerging, with few mature offerings available. Consent management projects will be driven by a strong collaboration between those concerned with policy and those concerned with the technological implications. Any participation in an HIE should be based on a clear understanding of the policies for consent management and whether those policies will be enforced centrally by the HIE, or whether this enforcement is a requirement of the end subscriber.

Business Impact: Little has been done to date to prevent clinical system users from accessing PHI that is beyond their required need to know. Role-based access controls typically permit users to access PHI available to their roles, even when such access is unnecessary or inappropriate. Application log management tools detect access after it has occurred. Patients and consumers concerned about the confidentiality of their PHI are less likely to participate in an HIE. HDOs and HIEs should capture consumer preferences using consent management tools suitable for automation, and apply those preferences systemwide.

Failure of an HIE to implement consent management could lead to failure of the HIE. However, most successful HIEs have implemented general opt-in or opt-out models without highly granular controls. Attempting to undertake an overly ambitious form of consent control could lead to technical and operational delays and failures. To implement fine-grained consent control, consumers are expected to take the time to define their consent directives concerning individuals and organizations.

Benefit Rating: Moderate

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: Deloitte; Global Patient Identifiers; HealthUnity; HIPAAT; InterSystems; Jericho Systems; McKesson; Optum; PresiNET Healthcare; Private Access; Wellogic

Recommended Reading: "Agenda Overview for Healthcare, 2013"

Enterprise Fraud and Misuse Management

Analysis By: Barry Runyon

Definition: Enterprise fraud and misuse management (EFMM) is software or services that support the detection, analysis and management of fraud or misuse across users, accounts, products, processes and channels. EFMM is used to monitor and analyze user activity and behavior at the application level, as opposed to the system, database or network level, and it watches what transpires inside and across accounts using any channel available to a user.

Position and Adoption Speed Justification: EFMM is most commonly used in vertical industries that manage money and benefits, such as banking, brokerages, insurance, retail and government. EFMM is just beginning to be used to detect internal fraud and unauthorized data access within healthcare providers. Technically, EFMM can be used in any enterprise that experiences fraud or data misuse. Gartner identifies five distinct layers of fraud prevention (see "The Five Layers of Fraud Prevention and Using Them to Beat Malware"), ranging from endpoint-centric tools (Layer 1) to pattern-based intelligence applications (Layer 5). EFMM solutions fall into Layer 4 and Layer 5 of Gartner's Fraud Prevention framework. Layer 4 products (for example, Cerner and FairWarning) detect fraudulent transactions or unauthorized activities as they occur across the enterprise. Layer 5 products (for example, Centrifuge and SynerScope) detect collusive activities or organized crime using pattern-based intelligence. Layer 5 typically involves "big data" aggregation coupled with visualization tools for network investigation.

Healthcare delivery organizations (HDOs) must more proactively monitor and detect unauthorized access and disclosures of protected health information (PHI) in an effort to reduce and prevent healthcare fraud and misuse. The U.S. Department of Health and Human Services (HHS) has increased the pressure on HDOs through increased Health Insurance Portability and Accountability Act (HIPAA)/Health Information Technology for Economic and Clinical Health (HITECH) Act compliance audit activity, and by imposing more-significant fines and penalties on transgressors. While EFMM is still in its early stages within the healthcare provider space, it is likely to see increased adoption during the next several years as HDOs concentrate on emplacing the strategies, policies and technical controls to mitigate risk in response to increased compliance scrutiny and enforcement.

User Advice: HDOs are likely to achieve EFMM success earlier with Layer 4 products because of their reduced cost and simplicity, compared with Layer 5 products. HIPAA explicitly calls out application log review as a best practice for ensuring privacy and security. However, most HDOs do not have log management in place — and if they do, they struggle to extract meaningful and actionable information. To combat the rising tide of fraud and misuse, HDOs should track and monitor user access to sensitive patient data by examining the application log entries that are routinely generated by their critical business and clinical systems. Application log management is one of the least invasive EFMM solutions available, and uses the natural byproduct of most business and clinical vendor applications within the HDO.

Business Impact: EFMM has the potential to improve an HDO's compliance posture. It also has the potential to reduce the risk of fraud and misuse related to unauthorized PHI access, as well as potential fines, penalties, and damage to brand and reputation.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Attachmate; Cerner; FairWarning

Recommended Reading: "As HIPAA Regulations Get Teeth, Healthcare Firms Feel the Bite"

"Mitigate Breaches With Real-Time Discovery"

"Who's Who and What's What in the Enterprise Fraud and Misuse Management Market"

Master Data Management

Analysis By: Vi Shaffer; Zafar Chaudry, M.D.; Barry Runyon

Definition: Master data management (MDM) is a technology-enabled business discipline to help organizations achieve a "single version of the truth." It seeks to provide consistent and uniform sets of identifiers and extended attributes that describe the core (data) entities of the enterprise. This entry tracks the introduction and progression of the MDM discipline within healthcare delivery organizations (HDOs).

Position and Adoption Speed Justification: In general, the necessity for true enterprise MDM in the future is still mostly unacknowledged among health systems and often confused with metadata or enterprise master person index (EMPI) activity. Therefore, we have nudged it ahead only slightly in the 2013 Hype Cycle. On the other hand, MDM is becoming recognized as a required discipline by more advanced and complex HDOs with electronic health record (EHR) systems in place and integrated clinical or business enterprise data warehouse (EDW) initiatives underway. The trigger is usually their pursuit of advanced performance analytics with an EDW, although the benefits of MDM are not limited to analytics. We are specifically flagging the importance of MDM within this healthcare Hype Cycle, because this requires serious attention from more HDOs as they embark on substantial new investments to leverage clinical data, and business initiatives to coordinate care among previously siloed entities.

The MDM discipline needs to support the HDO in acting like a system, and starting from a consistent and dynamic foundation in such important categories as patients (EMPI), clinicians or employees, diagnoses and procedures, charges, and supply or device items.

In addition to making more-complex uses of data, HDOs must have sound enterprisewide processes for keeping up with regulatory, public reporting, operational management, and service payment requirements and standards (ICD-9, ICD-10 and ICD-11 being some obvious examples). All this requires constant vigilance and formal management regarding the standardization and quality of data. Whereas many aspects of defining and maintaining components of MDM for healthcare are handled by various vendors (such as EMPI) and healthcare megasuite and ERP providers, it is the right time for larger, more mature HDOs to formalize MDM. This is most likely the first specific enterprise information management program that HDOs will adopt to formalize the necessary technology to support information governance and data stewardship. It is, therefore, a foundational piece for gaining high value, consistency and economies of scale from enterprisewide transactional applications, management systems, and business or clinical analytics.

Challenges in taking on true MDM include competing priorities, lack of management and stakeholder support, immature products and services, confusing vendor messaging, and a long time to value. ROI (in terms of net present value, payback period and internal rate of return) is a good thing but difficult to determine for MDM. For MDM to gain more traction, HDOs will need more

evidence of infrastructure necessity (the things the enterprise just can't execute readily, quickly or consistently as an enterprise with MDM would) and more evidence of benefits (revenue enhancement, cost avoidance or containment, compliance, and business risk mitigation).

User Advice: MDM typically is not highlighted by CIOs as a priority, but its importance is implied by initiatives like EHR systems and clinical decision support, business intelligence, collaboration, legacy modernization, and ERP. In 2013, numerous reporting requirements and analytics opportunities (as surfaced by the prominence of healthcare analytics in this Hype Cycle) already make it clear that HDOs are speeding up their journey toward world-class MDM in conjunction with building a strategic view of information as a differentiating asset.

However, by 2020, a new generation of knowledge management will become the essential core competence. Knowledge management must be designed to yield real-time or predictive awareness of process risks, prompts for active interventions or corrections to prevent process breakdowns, and the agility to execute new medical or care process innovations far more rapidly and pervasively than is done today. The underpinnings of these capabilities are sound MDM and the executive acknowledgment, culture change and IT investments to make it happen.

An MDM initiative is a long-term practice, not a short-term project. MDM is never truly a complete project, as there will always be new data and new data sources coming into the organization. The MDM process is guaranteed to rattle the culture of the organization (just like other system standardization efforts do), and that is often a factor contributing to HDOs not pursuing MDM.

Many HDOs are just beginning the MDM journey by creating data analytics teams, starting data management projects, cleaning up "messy" and inconsistent enterprise data, improving the quality of master files, and wrapping some MDM into a larger information life cycle management strategy. Gartner recommendations include:

- Take an integrated, holistic enterprise approach to MDM, weaving the various industry standards bodies' and application or analytics vendors' MDM-related content or tools into the overall approach. Good MDM can be sustained only when connected with executive commitment and sound processes for information and data governance.
- Use Gartner's MDM Framework, using the seven building blocks of MDM (a subset of the wider Gartner Enterprise Information Management Framework). This will help your HDO see the "big picture" for MDM and what will be involved in its creation. Leverage the increased interest in clinical-data-derived analytics.
- The most successful MDM projects begin with easily discernible goals and a relatively quick time to value. Create a phased approach that solves early challenges but is easily expandable to other areas of the organization, allowing the MDM project to show initial value and build momentum throughout the HDO.
- Explore, define and agree on where business users rely on master data across business processes and IT systems. MDM includes setting up governance and management responsibilities, roles and processes with the business and clinical leadership. This is a process that the CIO, chief medical informatics officer (CMIO) or clinical informatics officer (CCIO), and director of enterprise data warehousing (once this position exists) should help define and lead.

- Data quality — and related stewardship responsibilities — is a critical component to MDM and must be considered as part of any MDM initiative. IT and the organization often blame one another for data quality issues. Business and clinical leaders must own data quality and completeness. IT needs to have an active role in offering solutions to help the business address data quality problems. However, remember that organizational processes are just as critical as technology when implementing and maintaining clean master data.
- Using a vocabulary server is one good start and should be included in EDW initiatives. Use tools at the enterprise level that reach beyond the master data responsibilities of individual vendors and applications.

Business Impact: While it can be difficult to justify with an ROI on its own, MDM is one of the best-practice areas that are most appreciated when they do not exist, and when broken consistency and quality of data get in the way of everything else an HDO wants to do with it. Many HDOs continue to grow in size and service scope, while experiencing a much greater complexity and criticality in IT's support of the patient care process. Moving to an enterprisewide and more mature approach to MDM enables the HDO to keep order. This is particularly important as the pressure to cut costs increases at the same time that HDOs and related government e-health initiatives are focused on a greater level of patient engagement and care coordination.

Other indirect benefits of MDM include improved reporting accuracy, decision support, patient safety, regulatory compliance, customer satisfaction and asset utilization.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Health Language; IBM; Informatica; Information Builders; Oracle; SAP; SAS; Tibco Software

Recommended Reading: "MDM 'Primer': How to Define Master Data and Related Data in Your Organization"

"Where to Get Started With Master Data Management"

"Organizing for Master Data Management: People and Process"

"Top Actions for Healthcare Delivery Organization CIOs: Introduce Enterprise Information Life Cycle Management"

"Top Actions for Healthcare Delivery Organization CIOs: Make Central Terminology Services a Cornerstone of Your Information Architecture"

IT GRCM Tools

Analysis By: Barry Runyon

Definition: IT governance, risk and compliance management (GRCM) is the management, measurement and reporting of IT policies and controls that have been put in place to address risk and to ensure privacy, security and regulatory compliance. IT GRCM solutions have policy and asset repositories, basic document management, workflow, dashboards, and survey and reporting functionality.

Position and Adoption Speed Justification: Despite substantial investments in time and capital, most healthcare delivery organizations (HDOs) struggle to find a systematic way to define, manage, and enforce the privacy and security policies and controls that are required to address reasonably anticipated threats, and to comply with industry and regulatory mandates. In the U.S., IT GRCM has been receiving more attention since the Health Information Technology for Economic and Clinical Health (HITECH) Act, which is part of the American Recovery and Reinvestment Act (ARRA), set the stage for increased enforcement.

IT GRCM is an emerging category of products that can improve an HDO's audit posture, reduce associated reporting costs, and help the organization more regularly assess its risk and real compliance levels. It involves people, processes, policies and technologies. IT GRCM tools provide a framework to bring these areas together. IT GRCM can assist an HDO in determining, in more concrete terms, how secure the enterprise is, and whether it has the right practices, policies and controls in place.

The installed HDO base is still quite small, and adoption has been limited to more mature organizations that have the process and policy foundations needed to capitalize on the technology. Adoption will be driven by a need to operationalize compliance activities and the implementation of mature, risk-oriented security programs. IT GRCM solutions provide policy content that is specific to IT controls, as well as support for the automated measurement and reporting of IT controls. The products may take input from control automation and monitoring tools, such as vulnerability assessment, configuration auditing, identity and access management, and security information and event management (SIEM) platforms. IT GRCM does not unify everything. It is directed toward a defined subset of functions to manage, measure, and report on risk and security controls.

Vendors that have technology in adjacent markets will continue to participate in the IT GRCM market. In particular, vendors that have capabilities in technical control data gathering infrastructure (vulnerability assessment and configuration auditing) will create overarching management and reporting functions that will deliver on some of the IT GRCM critical capabilities.

User Advice: An HDO that has implemented sound vulnerability management — that is, the processes and technologies used to discover and address security weaknesses before they are exploited, including patch management, security configuration management, SIEM, and application log management — should be well-positioned to implement IT GRCM technology. HDOs should:

- Revisit the enterprise security plan to ensure that current security requirements, along with the corresponding policies and technical controls that support the security plan, remain appropriate for truly anticipated threats and vulnerabilities.
- Use IT GRCM to determine the efficacy of the enterprise's security plan, and develop the capacity to demonstrate compliance with the U.S. Health Insurance Portability and

Accountability Act's (HIPAA's) privacy and security rules, as well as the Joint Commission's Information Management standards.

- Investigate IT GRCM systems that, at a minimum, integrate best with the enterprise's technical control infrastructure, offer a flexible document management and workflow capability, and have HIPAA regulatory content and policy templates.

Organizations that want to deploy IT GRCM technology must understand that the labor associated with policy development is significant. There is a wide variation in the scope and functional capabilities of the current set of solutions. An organization that has implemented good vulnerability management is well-positioned to implement IT GRCM technology.

Business Impact: HDOs are in urgent need of a systematic approach to security compliance management. HDO leadership must be able to determine its compliance posture by reviewing compliance reports and dashboard output that look at realistically anticipated threats, the policies that are currently in force, and the technical controls that are being used to protect important infrastructure and information assets. Without a holistic approach that automates the collection, analysis, and presentation of policies, processes, and control data — the evidence of due diligence and a standard of due care — more HDOs will suffer damage to their reputations, accreditation status and bottom lines as compliance lapses.

IT GRCM can improve an organization's external audit capability and improve its ability to analyze IT risk. Organizations can reduce compliance reporting costs by applying IT GRCM automation to the management of written policy content, the assessment of process-oriented controls and the audit of technical configuration settings. The technology can make it easier for an auditor to evaluate IT controls, which should reduce the number of unnecessary audit findings.

Benefit Rating: Moderate

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: Agiliance; Brinqa; BWise; ControlCase; EMC (RSA); IBM; Lumension Security; MetricStream; Microsoft; Modulo; Rsam; Symantec; Telos

Recommended Reading: "Critical Capabilities for IT Governance, Risk and Compliance Management"

"MarketScope for IT Governance, Risk and Compliance Management"

"Achieving IT GRC Success"

Workflow/BPM for Care Coordination

Analysis By: Wes Rishel

Definition: Workflow engines are a well-established technology that is frequently used to define and manage the execution of sequences of steps, some of which are executed by people and while others are automatically executed by computer programs. Business process management (BPM) is a discipline and set of tools used in collaboration with end users to analyze, design, measure and re-engineer automated and manual workflows.

Position and Adoption Speed Justification: This entry is about the combined use of these technologies for organizing the clinical and administrative processes across enterprises. Previously, we have tracked these technologies within a single enterprise when implemented as part of an electronic health record (EHR). If we were continuing to use that definition, then this technology would be approaching the midpoint of the Slope of Enlightenment, primarily through the use of workflow tools built into EHRs and ad hoc BPM methodologies used by various firms that assist in EHR implementations.

We have revised the context for describing this technology in recognition of challenges that healthcare delivery organizations (HDOs) face in dealing with accountable care organizations (ACOs) and other forms of payment for care coordination. Frequently, this coordination occurs across enterprise boundaries. In revising the context, we have radically pushed the technologies farther back in the Hype Cycle. The requirement for health information exchange (HIE)-based care coordination is well-recognized, and early products that can help are available, but it is still not clear what level of detail is appropriate for care coordination.

Our discussions with clients about architectures for multiorganizational care coordination indicate a clear need for workflow, but very few clients have decided whether to buy a general-purpose tool, or look for workflow capabilities embedded in care coordination applications or HIE software. A few HDOs are investigating BPM tools. For the most part, however, they will not decide to adopt the tools if the HDOs rely on workflow capabilities that are included with care coordination applications. They will continue to use tools that are built into the implementation methodology for care management products.

User Advice: As HDOs evaluate alternative courses for accountable care, one of their criteria should be the ability to manage clearly defined workflows for a large group of users. The ideal workflow system should integrate manual workflow steps with computer-to-computer interactions with the EHR or EHRs, patient scheduling systems and administrative systems.

BPM is a fundamental tool for bridging the communication chasm between users and business process owners on one side, and IT on the other. This communication is even more important than workflow technology in achieving IT-enabled organizational agility. At the same time, adopting BPM requires substantial education of users and technologists. HDOs should adopt BPM as a primary approach for enabling communication between end users and technologists. They must also invest in education and the gradual introduction of the methodology. It is an appropriate approach for identifying the current and future states of business processes.

HDOs should favor product combinations where the information created with BPM tools is automatically or easily translated into configuration metadata for operational workflow systems, and where the operational data gathered by the workflow tool is easily moved to the BPM tool to assist in evaluation and improvement in workflow designs.

Business Impact: Virtually every process that occurs in care delivery, accounting for care and managing operations can benefit from BPM. Of particular note are processes that cross the domains of multiple application systems and those that are not handled by any application. Many application integration projects fail because its developers don't really understand the underlying workflow. Processes that involve coordination with other organizations are also likely targets.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Appian; Epic; Fujitsu; Infor; Oracle; Pegasystems; Siemens Healthcare; Tibco Software

Recommended Reading: "Magic Quadrant for Intelligent Business Process Management Suites"

Sliding Into the Trough

Continua 2012

Analysis By: Wes Rishel

Definition: Continua Health Alliance (Continua) is a global industry alliance that creates open interoperability guidelines for personal connected health monitoring products and services. It provides a logo for products that pass its certification tests and promotes adoption. Continua's 2012 Design Guidelines (CDG2012) are the most recent set of specifications in production use. CDG2012 supersedes the Continua Design Guidelines CDG2011, which we detailed in "Hype Cycle for Telemedicine, 2012."

Position and Adoption Speed Justification: Continua specifications describe four kinds of interfaces:

- Personal device to aggregation manager (over Bluetooth, low-power Bluetooth, ZigBee healthcare protocol, near field communications or USB)
- Aggregation manager to telehealth service center (over WAN)
- Telehealth service center to electronic health record (EHR) or personal health record (PHR) over WAN
- Direct from the aggregation manager to the EHR or PHR

The aggregation manager is co-located with the personal devices. It provides patient identity services and manages the flow of information from multiple in-home devices. The telehealth service center is an optional component, a call center to support end users of remote devices.

Continua has more than 200 members, most of which are technology providers. Other members include three very large healthcare delivery organizations (HDOs), 13 international standards organizations, and government agencies from six countries. All but one of the 13 nonemployed members of its board of directors work for technology providers. Similar alliances have worked well for propagating interoperability technologies such as Bluetooth and USB. The approach, however, has yet to be proven in healthcare.

There has been progress. In June 2013, Continua identified 90 devices that had been certified for Continua compliance since 2007. These include weighing scales, blood pressure monitors, glucose meters, pulse oximeters, cardiovascular monitors, thermometers, strength monitors, prescription adherence monitors and peak flow monitors. Its website also included nine independent living activity hubs, which provide a unified access to networks. In the first five months of 2013, Continua certified 55 devices, compared with 48 in all of 2012. The number of devices available in any specific market may be much lower than the total certified because some of the certifications were for demonstration devices and submodules. Nonetheless, the data indicates a step up in manufacturers' interest.

After six years, Continua has achieved little traction when measured by actual use connecting home or portable devices to EHR systems. More traction has been achieved through manufacturers putting devices in consumer supply chains that upload data using Wi-Fi or Bluetooth-enabled smartphones to cloud-based, vendor-specific repositories. These devices do not use the Continua specifications.

Recently, however, Continua has begun to see progress in several countries. Denmark published the first public tender requiring Continua compliance in August 2012, with additional follow-ons; the Singapore Ministry of Health Holdings announced it is requiring Continua certification for all personal health devices and services offered within its National Health Platform; in England, the Worcestershire County Council issued the first tender under the country's ambitious 3millionlives telehealth re-engineering initiative. The English tender includes two key Continua standards, although it does not require certified devices. Other national initiatives include Japan, with commercial deployments that require the use of Continua standards; and Abu Dhabi, which is developing a Continua standards-based mobile platform. To date there are no U.S. procurements or regulations that require Continua standards or certification.

Each of these tenders offers Continua the opportunity to prove its value proposition. Some questions needing answers include: (1) will plug and play interoperability be achieved in practice, at the technical as well as clinical data levels; (2) will manufacturers and labelers step up to the support requirements in multivendor configurations; (3) will the operators of large-scale telehealth initiatives be willing to restrict competition in the supply chain by restricting purchases under their programs to certified devices; and (4) will the hub-based architecture conceived by Continua in 2007 be acceptable and add value in the high-mobility, cloud-based market that has developed for consumer devices?

Continua advocates argue with justification that the value proposition is strongest at a very large scale, with many manufacturers in a supply chain to consumers and consolidated, cross-modality data flowing to HDOs, and that it removes complexity from the overall healthcare system by enabling the use of standardized hardware and software modules. In the Internet era, there is a

counterargument that standardization is slowed by trying to do everything at once. Gall's Law seems to describe the slow adoption of Continua. It says "A complex system that works is invariably found to have evolved from a simple system that worked" (see "Maverick* Research: Lessons Learned From Case Studies for Ultralean Development").

As Continua works to prove its value proposition, the growing number of certified instruments and tenders portends progress. Gartner's methodology, however, does not indicate that we should advance Continua on the Hype Cycle until we see actual adoption.

User Advice: Until Continua can prove its value proposition in the pioneering efforts in Malaysia and Europe, HDOs in other countries (including the U.S.) are unable to rely on remotely monitoring Continua-based devices until they are available in the supply chains of their countries and covered by payers in their markets.

Governmental agencies that seek to pursue the higher level of patient engagement might benefit from specifying Continua compliance, but they are usually reliant on other agencies to approve the devices, and on the manufacturers to offer the devices in their markets. In addition, they have only speculation or sketchy evidence that care programs based on such devices can produce measurable improvements in population health status or costs. Such agencies may find it advantageous to wait until the current pioneering efforts have borne fruit, particularly since it is difficult to attract manufacturers into a market where their sales might be limited to pilot efforts.

An interim approach for immediate programs would be to rely on non-Continua devices in the supply chain, and work out arrangements to download data from vendor-specific cloud repositories directly or via personal health records. Even this approach involves significant investment and would not be suitable to any but early-adopting HDOs.

Business Impact: Home and mobile monitoring has the potential to substantially improve the quality of care and reduce costs by enhancing patient engagement; enabling more-frequent interactions with caregivers and healthcare providers, rather than periodic office visits; and enabling patients to remain in the community or at home. As these approaches become medically accepted and find an economic niche, Continua can greatly accelerate its adoption and decrease the total cost of using monitors by reducing the "technical therapy" required to get the monitors operating.

Benefit Rating: Moderate

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: Cisco; GE Healthcare; IBM; Intel; Medtronic; Orange; Panasonic; Philips Healthcare; Roche; Samsung; Sharp Electronics; Tunstall Healthcare Group

Recommended Reading: "Continua Will Be Critical to Moving Care to Home and Mobile Settings"

"Cool Vendors in Healthcare Providers, 2012"

IHE PCD 2010

Analysis By: Wes Rishel

Definition: The Integrating the Healthcare Enterprise (IHE) Patient Care Device (PCD) domain includes profiles for standard messages that communicate data that originates in PCDs such as infusion pumps and bedside monitors from intermediary medical device connectivity systems (MDCSs) to electronic health record (EHR) systems. However, PCD does not cover the interface from the medical device to the MDCS.

Position and Adoption Speed Justification: This project has been the source for important contributions to semantic interoperability. It includes the Rosetta Project, which has cross-referenced 1,400 representations of physiological parameters from instrument vendors, and identified 440 unique measurements. Each measurement has a standard code and a statement of the units of measure. Because these items have not been standardized in other code sets, a significant value that has arisen out of the PCD effort has been the Rosetta Project that created a consensus on these concepts and the codes for them. Those codes may now be adopted in messages that don't necessarily fully conform to the IHE PCD specification.

There are only a few MDCSs in the market, and Gartner has found little interest in PCD from clients. For this reason, we are not going to continue covering it in the Hype Cycle.

User Advice: In implementing EHRs, vendors and health delivery organizations (HDOs) should adopt the Rosetta Project measures as their standard representation of physiological monitors, and map instrument-specific measurements to the standard.

Where a PCD or MDCS vendor and an EHR vendor both support the PCD profiles, HDOs should use the profiles, rather than ad hoc interfaces. In acquiring an MDCS or PCDs, HDOs should prefer vendors that support IHE PCD. However, at this time, HDOs should not restrict their acquisitions to only those vendors that support the profile.

Business Impact: Standardizing the EHR interfaces for PCD data provides nominal improvement in overall EHR implementation costs and may provide nominal to substantial savings when adding new instruments.

Benefit Rating: Low

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: Capsule Technologies; CareFusion; Cerner; Epic; Hospira

Recommended Reading: "CIOs Should Use These Guidelines to Ensure Healthcare IT Megasuite Vendors Don't Handcuff Their Futures"

"The Evolving Market for Universal Medical Device Buses"

Unified Communications

Analysis By: Zafar Chaudry, M.D.

Definition: Within HDOs, the conventional PBX and pager are giving way to IP telephony and a variety of desktop and mobile devices. Unified communications (UC) enhances user convenience and productivity by merging presence, voice, data, video, messaging conferencing components, networks, devices and systems into a common set of user interfaces on the desktop and on mobile devices. Benefits include better use and management of enterprise communication systems and the integration of these systems with business processes.

Position and Adoption Speed Justification: UC brings presence, voice, data, video, messaging and conferencing components together through a desktop interface and, more recently, the mobile device. Challenging economic times necessitate improved operational efficiency — while also meeting patient care and regulatory requirements. By reducing human latency, improving collaboration, and enabling individuals and groups to improve their communications application management, UC offers healthcare delivery organizations (HDOs) tangible business benefits. These benefits include improved patient care, operational efficiency, better compliance, lower costs, and the ability to deliver new and innovative patient care services. UC vendor offerings vary widely in capability, functionality, maturity and cost differences. Nearly all vendors depend on partnerships to complete their portfolios. UC adoption levels are expected to improve, and enterprises that have already adopted basic UC solutions will start to look for more sophisticated integration.

Interest in UC within the HDO is driven by the increased use of wireless and mobile devices to extend the reach and effectiveness of the HDO's expensive clinical and business systems, and by the need for better clinical collaboration and care coordination. Inhibitors include the lack of more complete vendor offerings, the maturity and complexity of existing offerings, and security concerns. Hands-free communication devices, such as Vocera's Communication Badge (which responds to voice commands, receives text messages and integrates with the enterprise PBX) or Ascom's Wi-Fi handsets (which allows voice calls on Wi-Fi, receives text messages and integrates with the enterprise PBX), are being used in HDOs now and are beginning to redefine how mobile workers communicate. UC enables the delivery of real-time information to clinicians. Bring your own device (BYOD) will also have an impact on UC. Successfully deploying a mobile UC solution in a BYOD environment means meeting several requirements that address the challenges and needs of all the stakeholders. Areas to address include security, control and ease of management, as well as keeping the operating costs low. Users want the convenience of using their devices for business and personal communications without compromising on the ease of use. UC solutions should not only secure, but also provide heterogeneous support to a variety of platforms for tackling the continuously growing device choice in the smartphone and tablet market.

By quickly relaying time-sensitive data, UC plays an important role in risk mitigation by reducing the possibility of errors and unnecessary treatments. With UC, clinical messages are delivered securely, with full data encryption and enforced user authentication. The secure communication feature of UC keeps information in electronic health records (EHRs) safe, enabling HDOs to meet stringent compliance requirements. Mobile UC products and services are now maturing (for example, from BlackBerry, Apple and Android), and their ability to integrate mobile phones with IP telephony and

UC systems is compelling. These solutions give members of the workforce the ability to enjoy many of the same features on their mobile phones that previously were only available on desktop phones and softphones. Products and services vary greatly among vendors, mobile phones and mobile operators. Over time, mobile UC will become a standard feature of enterprise IP telephony and UC systems.

User Advice: HDOs should:

- Evaluate a UC vendor's road map to understand its future product strategy, its support for interoperability and open standards, as well as its healthcare-specific offerings. Right now, a single UC vendor may not provide a complete UC portfolio, or may not have the best solutions across all UC product sets and services for healthcare. Therefore, HDOs should challenge UC vendors to demonstrate their integrated healthcare UC offerings, or consider deployment of UC components from different vendors (some of which will not yet work together effectively).
- Review business and clinical workflows to determine how these could benefit from being communication-enabled. Pilot programs should be undertaken first to evaluate feasibility and estimate time to value. Develop a robust business case from the pilot program to determine total cost of ownership and any potential ROI. A migration path should then be established so that, as communications equipment and systems are acquired or updated, they have a better chance of fitting into a broader UC vision. Look for benefits (such as productivity or patient safety enhancements) to justify UC applications, rather than developing a business case based entirely on cost reductions. Currently, it is difficult to assign a hard ROI to UC deployments, and there is limited experience with best practices. HDOs that wait for a clearly established ROI before conducting pilot evaluations will miss out on workflow improvements and a potential competitive advantage.
- Holistically define the requirements of any UC deployment and the principal stakeholders involved.
- Provision the existing data network infrastructure for the introduction and added weight of UC traffic, because ill-conceived UC implementations will result in poor quality of service. UC traffic is uniquely sensitive to delay, jitter and packet loss, especially when compared with non-real-time data traffic that has historically occupied the majority of network bandwidth.

Business Impact: With increased automation and mobility in support of complex business and clinical workflows, telephone and paging systems are no longer the optimal communication devices. UC improves communications among individuals and groups within the HDO. This is reflected in more-timely secure access to critical clinical information and faster responses to events. For the HDO, this can result in improved caregiver communications and collaboration, improved patient safety and care, and the more efficient utilization of human and material resources. The benefits of UC are best realized when integrated with clinical applications and processes. Communications-enabled applications allow clinicians to securely communicate and collaborate directly within the applications (for example, EHRs) and devices they use routinely. UC with good applications will also help achieve a common set of services while satisfying the insatiable user demand for BYOD.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Sample Vendors: Aastra Technologies; Alcatel-Lucent; AT&T; Avaya; Cisco; Huawei; IBM; Microsoft; Mitel; NEC; ShoreTel; Siemens Enterprise Communications; Toshiba

Recommended Reading: "As the Mobility Movement Gains Momentum, Healthcare Delivery Organizations Must Prepare to Adapt"

"Top 10 Tips to Prepare Your Network for Unified Communications and Collaboration"

"A Technology Framework for Enterprise Unified Communications"

"Magic Quadrant for Unified Communications"

"How to Determine Readiness for Voice, Video and Unified Communications"

"Use These Best Practices to Manage IP Voice, Video and Unified Communications Deployments"

Semantic Interoperability/Healthcare

Analysis By: Wes Rishel

Definition: Semantic interoperability in healthcare is the exchange of important clinical information among organizations that have different clinical information system products with sufficient granularity for care management, clinical decision support, research, quality assessment and sophisticated business intelligence. Data that would be called "semantically interoperable" is often referred to as "computer-processable."

Position and Adoption Speed Justification: There are many issues that confound interoperability other than semantics. For example, data transfer from laboratory systems to electronic health records (EHRs) has to overcome barriers that relate to the business issues between the lab and practices, and the technical approach to authenticating the endpoints, securely exchanging data and network reliability. Here, however, we are only considering issues that are manifest in the data itself, including the format in which data is structured, the implicit or explicit context of the data, and the codes that are used to convey the data.

The term "important" in our definition is vague in a manner that reflects the character of all discussions on semantic interoperability — as soon as it is achieved for some class of data, attention will immediately be focused on the next. For the purpose of positioning semantic interoperability on the Hype Cycle, we are currently considering the following classes of data to be important: prescriptions; problems (expressed at a clinically useful level of detail); current medications; medication history sufficient to judge patient compliance; medication allergies; lab orders; clinical lab findings, including microbiology; and radiology orders and findings. In general, where data is coded the code sets mutually understood by the two organizations should be sufficient for all of the data on 95% of the patients, and 95% of the data on the remaining patients.

Advances in semantic interoperability have been minimal since last year's Hype Cycle report. The European eHealth Project (epSOS) program brought a number of intercountry pilots for prescription data; completing pilots is a step forward and promises a bigger step when the pilots are expanded into a full-scale production. However, structured data on prescriptions has historically been more available from systems that support fulfillment and payment.

Many U.S. organizations have managed to exchange Continuity of Care Documents (CCDs), but only when the receiving system is the same product as the sender or when the receiving system interprets the Clinical Documented Architecture (CDA) as text, rather than structured data. If the receiving system is able to interpret the CDA header as structured data it may assist receiving users in filing it under the correct patient and classifying it. We refer to this very limited semantic interoperability as "computer-manageable" data, rather than "computer-processable."

A few organizations have managed to exchange semantic information, but only at the cost of substantial expenditures in bilateral testing. As a result of industry experience with the CCD, Health Level Seven (HL7) and other organizations have teamed to produce an improved set of specifications for use in the United States. It is referred to as HL7 Implementation Guide for CDA Release 2: IHE Health Story Consolidation, Release 1.1 — U.S. Realm of the consolidated clinical document architecture (C-CDA). The Centers for Medicare & Medicaid Services (CMS) and Office of the National Coordinator for Healthcare IT (ONC) have included the C-CDA in the requirements for meaningful use Stage 2, and specifically required the extraction of problems, medications and medication allergies in the definition of success.

Overall, we judge that semantic interoperability has moved ahead slightly in the past year and that there are promising developments for the future.

Some important adjunct technologies that are contributing to the progress in semantic interoperability include:

- The increasing prevalence of health IT systems that have sufficiently rich data models to create fine-grained, high-fidelity clinical data
- The use of terminology service providers for mapping terminologies and classifying natural-language documents
- The pending rollout of the C-CDA in the U.S. with embedded coded information
- U.S. federal regulations and certification requirements for EHRs to be eligible for "meaningful use" incentive payments
- The work of the in e-prescribing and clinical summaries
- The work of Integrating the Health Enterprise (IHE) in the patient care device domain to assemble codes and related units for physiological parameters

The remaining big challenges include:

- Achieving agreement on coding sets and, in particular, on balancing precision with ease of implementation. Countries that do not use English often must invest in translating the textual

descriptions of coded concepts into the country's language if they hope to achieve cross-border interoperability.

- Appropriate workflow when healthcare delivery organization (HDOs) receive incoming data from other sources. Physicians do not want to accept this data into their patient records without review and reconciliation. In the past two years, we have seen EHR developers begin to develop user interfaces to streamline physicians' reconciliation processes. This second challenge is less of an issue when data is being gathered for research, quality assessment and other kinds of analytics.

Our statement that the time to the Plateau of Productivity will be five to 10 years could be misinterpreted. Semantic interoperability already has been achieved for the intraorganizational exchange of certain classes of data, including prescriptions, chemistry, serology and hematology. Frequently, however, the interoperability requires bilateral agreement on codes and error handling. Semantic interoperability for the problem list and allergies are high on the priority list of standards developers. The five- to 10-year estimate applies to the time when semantic interoperability will be routinely exchanged for most clinical data within countries.

User Advice: Semantic interoperability will be achieved over many years, one class of data at a time. For a given class of data, the biggest challenge will be ensuring that the clinical systems that originate and process the data support comparable levels of structure and encoding. It will not be feasible to have cooperating organizations switch the standards as new classes of data become semantically interoperable. What is required, instead, is "incremental interoperability," an approach where the same standard supports computer-manageable and computer-processable data. The HL7 CDA is explicitly designed as a vehicle for achieving incremental operability.

Because semantic interoperability usually requires substantial efforts to create code mappings and keep them up-to-date, HDOs should include terminology service providers in their architectures for application integration.

Business Impact: More-granular, high-fidelity data for broader classes of data is an enabler for improved computer decision support, contributing to better quality, better care coordination, patient safety and more-automated compliance with external quality reporting requirements. It also supports more-sophisticated syndromic surveillance and epidemiology than is possible today. Finally, with more-semantically interoperable data, discovery of research candidates may be more automated than it is today.

Benefit Rating: High

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: 3M Health Information Systems; Apelon; dbMotion; Health Language; Oracle HTB; Unusual Visions

Recommended Reading: "Semantic Interoperability on the Hype Cycle for Healthcare Provider Technologies and Standards"

"In Healthcare, Application Integration Does Not Produce Fully Integrated Applications"

"Vocabulary Server Architectural Issues"

Legacy Decommissioning

Analysis By: Barry Runyon

Definition: IT systems are routinely replaced by more modern, functional or cost-effective alternatives. However, migrating legacy data can be so complex and costly that legacy systems are often left in service. There is a class of vendors that specialize in the vagaries of decommissioning legacy systems. These vendors offer a variety of approaches — from hosting parts of or entire retired systems in their facilities, to extracting and mapping the data to a repository or archive.

Position and Adoption Speed Justification: Legacy is considered such, because it has played an important role in satisfying organizational business requirements. It is likely to be deeply ingrained in critical enterprise workflows and business processes in ways that are both well-understood and unknown. Dependencies often surface only when a system is no longer available — and, even then, these dependencies may not show up until a quarterly or annual business process tries to access the system. Although users have been moved to a new system, once an HDO decides to leave an old system in place, the old system, now orphaned, continues to incur cost and liability.

Because of the cost and complexity of migrating or archiving legacy data, healthcare delivery organizations (HDOs) often take the expedient route and keep the associated system in service. This can come at a significant expense — in the form of facilities and hardware, as well as software licensing and maintenance, support costs, and associated personnel.

HDOs are still concerned about disposing of legacy data — particularly, clinical information. Most HDOs keep adult and pediatric medical records well beyond the limits stipulated by industry guidelines and U.S. state and federal regulations, and in some cases, they retain them permanently. Inhibitors to adoption, therefore, include the HDOs' reluctance to turn off old applications and systems when the dependencies and consequences are not clear, the general reluctance of the industry to migrate or purge data from storage fabrics, the cost and complexity of data migration and archiving, and the lack of vendor support for niche systems.

Legacy decommissioning is a daunting challenge for the HDO. Legacy decommissioning is in the trough, because HDOs are finding that most of the vendor solution market is fragmented, and that available solutions are limited and don't meet their expectations, and are more complicated and costly than they were led to believe. So, HDOs believe much work is left to be done. Also, like disaster recovery and similar "plumbing"-type IT initiatives, legacy decommissioning suffers from a lack of visibility and therefore support from upper management, when budget time comes.

User Advice: HDOs should take every opportunity to reduce the amount of legacy data they maintain. Legacy data that can be legitimately removed from the enterprise storage fabric should be deleted during decommissioning. Data that no longer has immediate value to the enterprise (based

on policy) contributes to unnecessary storage growth, storage-related spending and e-discovery risks. Investigate legacy decommissioning and data vendors. These providers offer a variety of approaches — from hosting parts of or entire retired systems in their facilities, to extracting and mapping the data to a repository or archive.

Legacy data vendors offer products and services at a reduced or fixed fee that can enable HDOs to continue to use and report on the information in a decommissioned system without the cost of maintaining the system. The disposition of legacy data should be an explicit part of an HDO's enterprise information management (EIM) and information life cycle management (ILM) strategies. Synchronize your application portfolio management (APM) and ILM strategies to ensure that, as applications and systems are replaced or retired, they properly account for the data.

Select a decommissioning vendor that offers a solution that can handle the most critical applications, systems and/or data in your legacy portfolio, and one you have the skills and resources to support. Successfully implementing a legacy decommissioning solution is dependent on the approach taken; the maturity and capabilities of the vendors found within that approach; and the organization's capacity to support specific domain, operational, infrastructure, personnel and project requirements for a particular vendor solution.

In the case of a data archive or repository approach to legacy decommissioning, the HDO must have the necessary domain, data modeling and integration expertise available to support the considerable data mapping, transformation, loading and movement requirements. The CIO must decide whether it will host the archive or repository solution within its own data center facilities (that is, support the particular hardware, software, network, storage, interfacing or integration, and support environment that the solution demands) or implement a remote hosted or cloud-based delivery model — in which case, closer attention to vendor and service-level management and security, and compliance concerns is a must. Vendor and service-level management capabilities are also critical to the success of the application hosting approach to legacy decommissioning.

Business Impact: IT systems regularly come and go, and they can leave behind a trail of hardware, software, personnel, data and users. When an application or system outlives its usefulness, the enterprise naturally wants to discontinue paying for its routine care and feeding. These direct and indirect expenses can be significant, and are related to, but not limited to:

- Hardware
- Licensing
- Maintenance and support
- Facilities
- Operations
- Service desk

Once an HDO decides to move to a new application or system, the old system often becomes an "orphan." However, it's an orphan with a price tag, particularly if it's not part of an APM strategy

that takes into account the details of legacy decommissioning. The most important aspect is the final disposition of its data.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Sample Vendors: Anthelio; Data Migration AG; Dell; EMC; Harmony Healthcare IT; Informatica; Laitek; Legacy Data Access; Medibase; MediQuant; OpenText; Summit Healthcare

Recommended Reading: "Cost-Cutting Measures Healthcare Delivery Organizations Can Take in a Difficult Economy"

"Top Actions for Healthcare Delivery Organization CIOs, 2013: Make Legacy Decommissioning a Priority"

"Maverick* Research: Sixteen Long-Followed IT Practices to Kill, When and Why"

"Account for the Data When Decommissioning Legacy Applications"

Direct Messaging

Analysis By: Wes Rishel; Barry Runyon

Definition: Direct messaging (usually just "Direct") is a means of sending protected health information as structured data, plain text or images that is more secure than email or fax. It enables pushing data from one covered entity to another, or to a patient's personal health record (PHR). It is formally described in "ONC Applicability Statement for Secure Health Transport" (see http://wiki.directproject.org/Applicability+Statement+for+Secure+Health+Transport). Its adoption is primarily in the U.S.

Position and Adoption Speed Justification: Direct messaging was covered in a previous Hype Cycle as Nationwide Health Information Network (NwHIN) Direct. Direct relies on a new kind of technology service vendor — healthcare information service providers (HISPs). HISPs provide the security infrastructure and message exchange for users in clinical organizations. Many HISPs provide secure portals through which an end-user could create and receive Direct messages. On the other hand, most of the use cases work best when end users initiate and receive Direct messages in the workflow of their electronic health record (EHR) systems.

Vendors of EHRs generally have established a relationship with a specific HISP. Under this relationship, the EHR vendor is responsible for integrating messaging into the user interface of its product and for onboarding user organizations. Major EHR vendors such as Allscripts, Cerner, Epic, GE, Greenway, Meditech, NextGen, Siemens and Vitera have indicated their plans to offer HISP services. Most of these vendors are reselling the services of third-party HISPs. A few EHR vendors have decided to operate the technology themselves and be their own HISPs. Some HISPs are listed

under sample vendors. Where that list includes an EHR vendor, it means the vendor itself provides the HISP functions for the users of its EHR product.

The concepts and technologies of Direct are less complex than those of full health information exchange (HIE). Because it is restricted to "pushing" messages, the policy issues are simpler and well-understood since they are the same policy issues that have applied to sending protected health information by fax. Consequentially, the need for supporting technology is much simpler. There is no need for the information exchange technology to confirm the authorization of a user to send a message to another; this is a major simplification. Direct is often compared to Healtheway Exchange (previously known as Nationwide Health Information Network Exchange; see http://healthewayinc.org). Healtheway Exchange enables query. Its protocols and trust agreements are substantially more complex.

The standards for Direct message interoperability were developed by a large group of HIE organizations, EHR vendors and interested third parties. A more challenging requirement for interoperability is the ability of HISPs to trust one another. Since last year's Hype Cycle, DirectTrust.org (www.directtrust.org) has worked out the legal requirements and teamed with Electronic Healthcare Network Accreditation Commission (http://ehnac.org) to create an accreditation program that verifies that a candidate HISP meets the requirements. DirectTrust.org has created "trust bundles," sets of online metadata that describe the technical information necessary for one HISP to begin interoperation with another. Currently, an HISP using the open-source software needs only to import the trust bundle for another HISP to begin to work with it. The ease of administering the inter-HISP trust relationship is another contrast with full HIE.

Some drivers and indicators favoring success include current use of Direct in several regional HIEs going back to 2011, and increasing usage of Direct among clients of EHR products. In early 2013, one vendor reported handling about 70,000 Direct messages a month among its own clients, primarily in support of referrals. A big driver arises because care delivery organizations seeking incentives under Stage 2 of Meaningful Use will have difficulty fulfilling the requirement to send structured information for 10% of referrals and other transitions in care without Direct. Finally, the innovative and simple approach for determining trust developed by DirectTrust.org is encouraging.

Some obstacles to the timely rollout of Direct include (1) EHR vendors developing user interfaces that smoothly incorporate sending and receiving Direct messages, particularly when incoming messages contained structured problem and medication data; (2) EHR vendors' willingness to adapt to state-mandated HISPs in a few states, rather than using their own or designated third-party HISPs; and the fact that Stage 2 attestation becomes required for healthcare delivery organizations (HDOs) gradually from 2014 through 2017.

We have advanced Direct along the Hype Cycle because of the Meaningful Use requirements, the services of DirectTrust.org and the Electronic Healthcare Network Accreditation Commission, and EHR vendor commitments all became available since last year.

User Advice: U.S. HDOs should plan to use Direct when available from EHR vendors, for all interorganizational pushing of protected healthcare information. This includes, but is not limited to,

the transfer of structured information that is required for 10% of discharges and referrals in order to qualify under Stage 2 of the Meaningful Use incentive program.

HDOs in other markets should consider Direct where: (1) there is a variety of health IT vendors; (2) retrieval-based information sharing may become a ponderously complex affair due to policy issues; and (3) the majority of interorganizational workflow is currently being handled by fax machines.

Business Impact: Healthcare exchange with community physicians has become important to hospitals. This importance will only increase as drivers, such as the need for better coordinated care and the creation of accountable care organizations, kick in. Direct can provide a basis of familiarity and trust that will be an asset in building more-complex business and technological relationships.

Benefit Rating: Moderate

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: Cerner; Covisint; Data Motion; eClinicalWorks; ICA Informatics; Infomedtrix; Inpriva; MaxMD; MedAllies; MRO Corp; RelayHealth; Siemens Healthcare; Surescripts

HIE

Analysis By: Wes Rishel

Definition: A health information exchange (HIE) is a collaboration among independent healthcare organizations to assist them in sharing clinical information. Often, administrative information is shared as well.

Position and Adoption Speed Justification: Two assumptions that underlie most HIEs are that physicians will seek information outside their own medical records while treating a patient, and that information could automatically be imported into the electronic health record (EHR) system of the healthcare delivery organization (HDO). Both these assumptions have been challenged in implementations. Even in emergency departments, the most likely locations for the use of ad hoc lookups, simply making the resource available seldom results in substantial usage.

To date, the ability to achieve semantic interoperability through HIEs has been very limited, and has depended on the HIE implementing mappings that enable the major data sources, such as hospitals and labs, to send data without having to conform to uniform standards for messages and code sets.

In the U.S., many public HIEs were created through $500 million in grants issued pursuant to the Health Information Technology for Economic and Clinical Health (HITECH) Act. In 2010, we predicted that these HIEs would often fail to develop into economically self-sustaining programs. Since 2012, our inquiries from CFOs and CIOs of healthcare organizations that have taken leadership roles in HIEs confirm the trend. Many are attempting to renegotiate software fees drastically downward, based on the lack of uptake. HIE software vendors are refocusing their sales efforts on privately funded and governed operators of HIEs.

Most of the large U.S. healthcare delivery organizations that Gartner talks to are creating self-funded HDO-based HIEs for interactions with their affiliated physicians to assist the physicians in achieving "meaningful use" incentive payments, and as a strategic first step toward enlisting them in accountable care and patient-centered medical-home efforts.

Globally, progress on HIEs is also variable. Many of the same barriers described above are being encountered. Government-driven HIE programs are frequently overambitious in scope and time frame, and unclear with respect to the tangible economic value that can be achieved in the first two or three years of implementation. In responding to top-down political imperatives, these HIE programs tended to neglect the needs of local organizations and clinicians, minimize concerns of privacy and data ownership, and not take into account the need to maintain and integrate with existing applications. This situation is gradually improving, although much more improvement will be needed for HIEs to become operationally sustainable. Most progress to date has occurred in smaller jurisdictions, where there is less variability in culture or the health system.

Denmark has a long-established program of information sharing. Clalit, the largest healthcare provider in Israel, operates an HIE that includes two non-Clalit hospitals. Scotland's national health service, NHS Scotland, has developed an "Emergency Care Summary" that extracts data from electronic medical record (EMR) systems and makes it available to clinicians in out-of-hours centers. The government of Sweden is deploying a "National Patient Overview," which collects summary data from acute care and primary care applications and makes it available through a national portal. Singapore's National Electronic Health Record has achieved an important milestone in HIE development: Most of the hospital data sources are contributing summary-structured data to a national repository, and physicians have portal-based access to this information. Like other HIE programs, Singapore has discovered variability in the way that source systems structure data, and actual uptake by physicians in their practices is an ongoing issue as well. As more physicians get EHR systems, there is increased potential to source data from the ambulatory environments. This will add value in referral to consultants, as well as transitions of care to hospitals. Because current EHR usage in ambulatory settings is low, Singapore has the opportunity to build interoperability with its National Electronic Health Record into the acquisition specifications for EHRs.

Australia's Personally Controlled Electronic Health Record program became operational in 2012, but has yet to build a critical mass of patient registrations. It envisions patients authorizing retrieval of information on a case-by-case basis. The Canada Health Infoway program is funding and guiding the development of HIE programs in Canada's provinces and territories.

Elsewhere in Europe, the Middle East and Asia/Pacific, many regional or national EHR projects are at different stages of development, with few success stories thus far.

The European Commission's Information and Communication Technology (ICT) for Health unit is collecting evidence of financial benefits from data sharing, and it is coordinating the European Patient Smart Open Services (epSOS), which aims to develop a common transnational approach to a patient summary record and prescription fulfillment. As many as 23 countries have participated in the Integrating the Healthcare Enterprise (IHE) Connectathon for Europe in 2012 and 2013, demonstrating technical interoperability. In April 2012, epSOS began a two-year, multinational test with participating patients among 72 points of care in 39 cities in Austria, France, Greece, Italy and

Spain. If the pilot is successful, it will demonstrate much more than just technical compatibility. It will show that the governance approach works in practice and allows countries to evaluate the cost (in time or money), versus the perceived benefits. If the volumes are high, the pilot may also help to determine if physicians will make use of an HIE in their daily workflows.

Some U.S. HDO-based and many public-based operators of HIEs are members of Healtheway (http://healthewayinc.org), a nonprofit corporation that has inherited the charter previously known as the Nationwide Health Information Network (NwHIN). This organization maintains the Data Use and Reciprocal Support Agreement (DURSA), which describes the obligations of member organizations regarding trust and services. It also selects and adopts standards and specifications, mostly based on HIEs. Healtheway standards are currently limited to queries. It has no agreements or protocols to push data. Most vendors in the U.S. that offer HIE technology also offer health information service provider (HISP) technology to support pushing health data by Direct messaging. However, HIE products generally include patient identity matching and patient data lookup and analytics capabilities that are not part of Direct messaging.

We have advanced the HIE position on the Hype Cycle this year based on increased transaction volumes in the best HIEs and greater purchasing and interest in HDO-based HIEs.

User Advice: U.S. healthcare delivery organizations that are finding the need to exchange data with community physicians critical to their practices must carefully assess the prospects of regional HIEs in establishing a sustaining economic model and a critical mass of participation to enable the use of secondary data.

Where there is no reliable prospect, HDOs should consider going it alone or in specific alliances without full public governance. In selecting vendors for their own HIEs, HDOs should evaluate their ability to support analytics and care management.

Non-U.S. healthcare delivery organizations, for the most part, will need to react to government-sponsored programs to set up HIEs. They should gauge their reaction based on whether the government program has clear, simple goals or is an attempt to achieve broad interoperability across heterogeneous products. In the former case, they should plan for a strong possibility of success and expect to participate. In the latter case, they should give nominal support and avoid substantial investments, unless they develop a more pragmatic approach.

Business Impact: HIEs enable increased data availability, which could lead to improved patient safety, healthcare quality and fraud control; more opportunities for patient home care and self-care; and a coalesced community of clinicians in a region to support other quality efforts.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Accenture; Caradigm; CareEvolution; Cerner; CGI; Covisint; CSC; Dell (Perot Systems); Explorys; Fujitsu Services; Harris Computer Systems; HealthUnity; IBM; ICA Informatics; InterSystems; OptumInsight; Oracle; Orion Health; Phytel

Recommended Reading: "The U.S. Nationwide Health Information Network Will Be a 'Network of Networks'"

"A Clear Definition of the Electronic Health Record"

"Case Study: Denmark's Achievements With Healthcare Information Exchange"

ICD-10 CM (U.S.)

Analysis By: Vi Shaffer

Definition: ICD-10 clinical modification (CM) replaces the more than 30-year-old ICD-9 CM, Volumes 1, 2 and 3, for reporting inpatient procedures in the U.S. Developed by 3M under federal contract, ICD-10 CM is a very substantial change in structure, as well as the volume of codes. It requires substantial changes for payer, provider and intermediary IT systems.

Position and Adoption Speed Justification: The position and its progress to the Plateau of Productivity for ICD-10 CM is not measured just on its mandated conversion date, which is a pass-fail event for both healthcare providers and payers, but on HDOs deriving patient care or business/financial value from that conversion. That will take several years beyond the conversion.

Since the July 2012 version of this Hype Cycle was published, Centers for Medicare & Medicaid Services (CMS) by final rule delayed the mandated conversion date by one year, and it now stands at 1 October 2014. In May 2013, the American Medical Association Board of Trustees, which had called for a delay and continues to focus on conversion challenges, issued a significant report and recommendation. The report evaluated the advantages and disadvantages of skipping deployment of ICD-10 in favor of waiting for ICD-11 and recommending against taking this approach. This report is publicly available at: www.ama-assn.org/assets/meeting/2013a/a13-bot-25.pdf.

In making the recommendation, the Board noted:

The implementation of ICD-10 is a divisive issue for the industry. While many physicians have concerns about the costs and burden of ICD-10, there are many other stakeholders, including government agencies, researchers, large payers, large health system providers, and public health 24 entities, that support the conversion.

However, this did not settle the AMA position. At its June 2013 annual meeting membership, AMA membership voted to lobby for a two-year mandated "implementation period by all payers, including CMS ... during which time payers will not be allowed to deny payment based on specificity of ICD-10/11 diagnosis. However, they will be required to provide feedback for incorrect diagnosis ...." Meanwhile, Farzad Mostashari, the U.S. National Coordinator for health IT put out a statement that there will be no additional deadline.

The U.S. Department of Health and Human Services (HHS) and the Workgroup for Electronic Data Interchange (WEDI) are continuing to monitor industry readiness, and there is reason for continued concern (www.cms.hhs.gov/ICD10). Although some stakeholders would just as soon see this process delayed further (or forever), delay magnifies the problem the American Hospital Association

has identified in its support for timely conversion: the ICD-9 CM classification system is "close to exhausting codes and is in critical need of upgrading ... without a switch to ICD-10 soon, hospitals will experience significant coding problems that will affect the efficiency of the current coding process, adding significant hospital operational costs."

Given the major priorities of U.S. healthcare delivery organizations (HDOs), such as reducing operating costs to match additional Medicare payment cuts and creating an effective accountable care organization (ACO) model, more than just better codes are involved in ICD-10 value. The inevitable panic among the ill-prepared, and legitimate worry among parties who have unready payment partners, will continue for some. The flip side of major change is opportunity, and innovative vendors, consultants and health systems will seize on the worries about coding and cash flow and the positive potential of the improved medical relevance of ICD-10 codes. They will leverage them for stronger end-to-end revenue cycle management and improved clinical documentation (for management and research), apply computer-assisted coding and computer-assisted/natural language processing tools to physician documentation, deploy techniques to protect themselves against underpayment during the transition and incorporate ICD-10 into analytics.

Note that the list below includes a representative sampling of major vendors providing RCM systems, clearinghouse services, coding content and readiness assessments, project oversight and education.

User Advice: ICD-10 compliance and revenue protection are mission-critical and pose a high risk to health system cash flow. HDOs and payers must not delay their planning and testing. Whereas last time around there were many signals leading Gartner and others to anticipate a delay, those signals are not present around the new date at this time. Even if a small delay happened, it would not be enough time to make up for inadequate readiness. Executives and CIOs, in particular, should view the ICD-10 conversion as three interrelated enterprise efforts, with collaborating leadership and task forces. Because the conversion will involve extensive efforts on the part of healthcare payers, HDOs and software vendors, the time just before and after the conversion period will be chaotic. The proper mindset is to plan meticulously and prepare for crises to occur. Be diligent in trying to ensure revenue and cash-flow continuity and optimization, including short-term borrowing options.

Conversion requires a release upgrade in core RCM and other systems — most of the systems that couldn't do it have been killed off already. Successful conversion requires the ability to capture necessary data for ICD-10 in all relevant systems and databases, requires substantial coder and clinician training, and requires a mapping ability in any BI system that includes revenue cycle analytics or needs to trend across the time period crossing the two standards.

The CIO and CFO share risk management responsibilities here. Most of the highest risks and contingency planning are around adequate data capture at documentation, coder productivity and cash flow, and fall under the CFO. Most of the value realization efforts fall under the CMO/CNO and Quality Department, with master data management (MDM) and warehousing support from the IT department.

Note that ICD-10 compliance and value efforts will be complicated by the regular bursts of merger and acquisition (M&A) activity in the industry.

1. The first effort is the ICD-10 revenue management program. This is led by finance and should include a multidepartmental steering committee chaired by finance/revenue management executives, which is where the IT organization is represented. This tracks all the people, processes and systems essential to good revenue management. The one-year delay enabled some health systems to complete their conversion to a Gen 3 patient financials system prior to the new date, but that window has mostly passed. The impact on HDOs is nearly as extensive as it is for payers, although a few HDOs still fail to grasp that, and naively regard ICD-10 as merely a problem that their vendors of billing and medical record coding software will address for them. CFOs should be deeply engaged in modeling and mitigating the serious cash flow and revenue risk that poor ICD-10 execution threatens.

2. The CIO or a delegate also needs to lead the Y2K-like system inventory and action plan that should be well underway. This is to: (1) identify all the additional IT-related systems that are touched by ICD codes and are not part of the revenue management core; (2) evaluate the readiness and business risks of each; and (3) develop a prioritized list and plan of attack. While not quite as massive an effort as Y2K, it is nevertheless, a substantial effort, with some CIOs quite surprised by just how many applications and databases are involved.

3. Infuse innovation and "megaprocess" management into revenue cycle management. Just complying with ICD-10, updating core IT systems, retraining coders, managing through the change management strategies of the transition period and inventorying IT systems for ICD-9 use are thorny enough matters (and don't forget the implications of ICD-10 in the use of clinical documentation terminology aids). However, more-progressive health systems are taking a third step. In reviewing the full ICD-10 conversion implications, they are also stepping back to evaluate their entire revenue management "megaprocess." There are challenges and opportunities for revenue management improvement For example, although it's getting very late to start new efforts, RCM re-engineering, consolidating business office operations can still be considered in some cases. Computer-assisted coding and documentation support also represent opportunities, and there has been a flurry of activity in this realm (including 3M buying CodeRyte, Nuance buying QuadraMed's Quantim, UnitedHealth Group Optum buying A-Life, and M*Modal 2012 privatization by One Equity Partners, the private investment arm of JP Morgan Chase). This approach now offers real promise in ensuring revenue integrity while getting ahead of the code conversion productivity hit.

4. Ride the right horses to the finish line. The representative vendors included in this entry cross the enterprise/hospital EHR document aids, coding/patient accounting applications, coding content and computer-assisted coding lines of business. We have not included consulting/ service providers, but they, too, can be helpful in various aspects of conversion planning and revenue management re-engineering, as potentially can revenue management outsourcers and coding services.

Business Impact: The biggest initial benefit of ICD-10 is to avoid the increasingly clumsy way new additions are being added into ICD-9 to avoid running out of codes, which yields messier and less-useful information for health management and payment schedules. The overarching benefit is to capture accurate, richer, more-useful and medically relevant data about the outcomes, efficacy, costs and complications of medical technology, and to ensure fair and equitable reimbursement policies. Rand has estimated that the cost of industrywide implementation will be between $450

million and $1.115 billion (spread over more than two million healthcare entities), plus productivity loss in the range of $5 million to $40 million per year. However, others have projected far higher costs — $6 billion to $14 billion.

The American Health Information Management Association (AHIMA), which strongly advocates conversion to ICD-10 CM/procedures (PCS), has stated that adoption would serve as a catalyst for the development of computer-assisted coding applications. AHIMA further states that a number of anticipated benefits of EHR systems cannot be achieved if the reference terminology employed, such as the Systematized Nomenclature of Medicine (SNOMED), is aggregated into a very dated classification system.

In the May 2013 report referenced above, the AMA considered benefits of ICD-10, listed as disadvantages of waiting for ICD-11, as follows: "Disadvantages of waiting for ICD-11 include continued use of outdated ICD-9 codes, impeding the building of knowledge and experience from ICD-10 to implement ICD-11, missing out on expected lower reliance by payers on claims attachments under ICD-10 and an unknown timetable for (U.S.) ICD-11 adoption that could range from several years to two decades."

Benefit Rating: Moderate

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: 3M Health Information Systems; athenahealth; Allscripts; Cerner; Deloitte; Dolbey; Encore Health Resources; Epic; GE Healthcare; Health Language; Infosys; Intelligent Medical Objects; Keane; McKesson; MedAssets; MedeAnalytics; Medicomp Systems; Meditech; NextGen Healthcare; Nuance; Optum; Precyse Solutions; QuadraMed; RemitDATA; Siemens; Stockell; The Advisory Board

Recommended Reading: "Top Actions for the Healthcare Delivery Organization CIOs, 2013: Become Obsessed With Total Revenue Management"

"Update: U.S. Care Delivery Organizations Should Use These Steps to Prepare for ICD-10"

"Update: Architecture for the ICD-10 Mandate in Care Delivery Organizations"

"Patient Financial System Requirements in U.S. Vendor Selections: Part 2 (Functionality)"

"Patient Financial System Requirements in U.S. Vendor Selections: Part 1 (Technology, Architecture and Services)"

Detailed education materials on ICD-10 CM and PCS, as well as an ICD-10 Q&A, are also available through the CMS website at www.cms.hhs.gov/ICD10.

End-User Experience Monitoring

Analysis By: Barry Runyon

Definition: End-user experience monitoring is technology put in place to monitor, measure and continuously improve the end user's experience in using enterprise applications and systems. Gartner has described four end-user experience monitoring technologies: (1) passive monitoring of proxy end-user experiences; (2) active monitoring of end-user experiences; (3) end-user behavior capture and playback; and (4) cognitive, model-based subjectivity tracing.

Position and Adoption Speed Justification: Of the four varieties of end-user experience monitoring, passive monitoring of proxy end-user experiences is the most widely deployed, but deployment of the other three is rapidly picking up pace (see "The Four Varieties of End-User Experience Monitoring"). The increased automation of clinical and business processes within the healthcare delivery organization (HDO), along with outreach and interoperability initiatives, has increased the number of IT systems that contribute to the electronic health record (EHR) and the number of systems that are now considered mission-critical. Systems are more modular, distributed and interdependent. Therefore, they are more complex and difficult to monitor end to end. Because of their status within the enterprise, they require high levels of performance and availability, and shorter recovery times to ensure patient safety and a positive end-user experience.

As complex, modular, and distributed clinical and business applications take hold within the HDO, within and across care venues, and the general principles of service orientation are embraced, the boundaries between the application and infrastructure continue to blur. A more dynamic, but more difficult to manage IT environment has become the norm. HDOs will need to collect and analyze information from various places in the IT stack to ensure optimum performance, availability and system integrity. Tools and operational best practices will be required to monitor and manage the many components, devices, services and virtual counterparts that make up this more modern and sophisticated IT environment. The degree to which an HDO makes use of this information and the related tools to inform best-practice frameworks, such as ITIL, will determine its level of infrastructure and operations (I&O) maturity and its commitment to service management. Increased remote and cloud hosting by HDOs and the need to gather information to enforce service levels will also drive adoption.

The end-user experience monitoring tools listed within this entry have been around for some time. Only recently have they been adopted and applied to improve the performance and availability of the software systems and vendor products that support the clinical workflows within the HDO — whether run on-premises or remotely provisioned by a vendor. End-user experience monitoring tools often require time-consuming, complex and expensive deployments and, as a result, have been affected by the economic downturn and competing IT priorities. Interest in end-user experience monitoring, as measured by the number of Gartner healthcare provider client inquiries, has been negligible over the past year. As a result, we have extended our time to plateau estimate to 5 to 10 years.

User Advice: HDOs should use end-user experience monitoring tools to proactively measure application availability and performance from the end user's perspective. Most enterprises will need more than one set of tools to satisfy the needs of the end user and IT operations. Correlate important business and clinical workflows to the underlying IT infrastructure components they depend on. Analyze and use the data that is already being collected by existing application-, infrastructure- and security-monitoring tools to improve overall IT infrastructure performance and

availability. Deploy end-user experience monitoring management tools in conjunction with major clinical system implementations to compensate for vendor-system-monitoring functional gaps, along with help desk and incident management tools and best-practice frameworks, such as ITIL, to improve I&O maturity levels. HDO IT departments will require timely infrastructure intelligence, combined with best practices, to support an increasingly complex and real-time healthcare system.

Business Impact: HDO IT leaders are often unaware of the health of their IT infrastructures and where potential performance bottlenecks or risks to availability reside. Properly supporting an increasingly automated and accessible clinical and business IT environment will require up-to-the-minute intelligence. Application performance management tools and associated best practices make it possible to reduce unplanned downtime, improve overall system availability and responsiveness, and, thereby, enhance patient safety and physician satisfaction.

Most clinical system vendors do not provide adequate tools for monitoring system service levels. With more systems in the HDO participating in the EHR and, therefore, becoming mission-critical, end-user experience monitoring tools will be deployed to enforce IT service levels and monitor the quality of the end-user experience. For remote-hosted, software-as-a-service and cloud-based systems, this could result in significant cost savings by these service providers to agreed-on service levels. The only legitimate vantage point from which one can capture data about the performance of a given application from an end-to-end perspective is the user interface. Monitoring tools in this domain are concerned with how the quality of the user experience or how an application or system is executing user-defined transactions.

Benefit Rating: Low

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Sample Vendors: BMC Software; CA Technologies; Compuware; Empirix; Heroix; HP; Nimsoft; Quest Software; RadView Software

Recommended Reading: "The Four Varieties of End-User Experience Monitoring"

"A Quick Look at Cloud Computing in Healthcare Payers and Providers, 2012"

Infobutton, R1

Analysis By: Wes Rishel

Definition: HL7 Version 3 Standard: Context Aware Knowledge Retrieval Application ("Infobutton"), Knowledge Request, is an interface standard by which an EHR or another clinical system obtains clinical content from an online third-party content provider by sending information about the patient's condition (context information). The type of content requested is not limited, and may be clinician-targeted or patient education materials. Infobutton does not imply that the standard requires a button or any other specific user interface artifacts.

Position and Adoption Speed Justification: Vendors are required to have their products certified using this Health Level Seven (HL7) standard for the 2014 edition of the regulations for certification of EHRs under the meaningful use program. Vendors will generally undertake this certification in 2013 to meet the needs of their early adopters.

While the U.S. Office of the National Coordinator for Healthcare IT (ONC) rule for Stage 2 requires certification of Infobutton, R1, the Centers for Medicare & Medicaid Services (CMS) rule for user organizations does not require its use. For most standards, this would imply very low adoption. Nonetheless, we think that adoption of this standard will grow because it is dead simple, and the basic approach has been in use for a few years by some major electronic health record (EHR) vendors and multiple content providers. We have reports from some large EHR vendors of production use of these interfaces in a number of client sites. Some of their clients use the approach to support contracts with multiple content sources. One vendor has a client that connects to seven different content sources using this approach.

The standard describes a pair of actions — a request for information and a response. The request may include a topic (such as a problem, finding or procedure), a subtopic, a severity code and contextual information, such as the patient's age and gender. It does not, however, include information sufficient to identify the patient. The request may be formatted as a Web service request or an HTTP request including straightforward XML based on HL7 Reference Information Model (RIM).

There is no standard for the response; one approach commonly used today is to have the response include a uniform resource identifier (URI) that is used by the EHR to present Web pages from the content provider. These pages include the content, but can also support ongoing interactions between the EHR user and the content provider to further refine the request for information. For example, the content provider may provide a list of titles enabling the user to select a document or, when presenting a document, it may include a table of contents enabling the user to jump to a specific section. In this approach, the EHR temporarily cedes control of the user interface to the content vendor.

Infobutton is not a "plug and play" standard in that the EHR developer and the content provider have to agree on the general category of topics and the handling of the response. Purists might describe the lack of a standard response as a "deal killer." Nevertheless, the uptake of the prior version indicates that it is a pragmatic approach that substantially reduces the variability and cost of matching up EHR products with content products, and has strong support from vendors on both sides.

There are important economic and practical drivers for the Infobutton, particularly the fact that content is provided online, one request at a time. When compared to the alternative, importing all the content into the EHR, the transactional approach facilitates timely updates by the content provider, as opposed to infrequent batch updates. For example, content on adverse impacts of medications or infectious diseases could be updated in a matter of days, rather than over the course of a year. Furthermore, this approach enables the content provider to tune the algorithms for selecting content based on experience and current events. Finally, this approach offers the content provider tighter control over its intellectual property.

Because of the simplicity, the economic drivers and current usage, we have advanced Infobutton, R1, and maintained our estimate of its time to plateau.

User Advice: Infobutton is well-suited for content retrieval, and should be considered first when arranging for third-party content. Some advocates are promoting Infobutton for another use case, providing clinical decision alerts through a third-party rule engine. We do not recommend such an expansion of the purpose of the standard.

Business Impact: The Infobutton standard will enhance the availability of third-party content from a diverse set of sources. Making content more easily available will support better clinical decision making when targeted at the clinician, and better patient engagement when targeted at the consumer.

Benefit Rating: Low

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Epic; Healthwise; MedlinePlus; Wolters Kluwer

GS1 Healthcare (GDSN)

Analysis By: Vi Shaffer; Steven Lefebure; Eric O'Daffer

Definition: This entry tracks progress toward the adoption of the Global Data Synchronization Network (GDSN), the culmination of data sourcing and agreed-on processes designed to ensure an authoritative method for ensuring that information about products and supply chain partners comes from its original source (the manufacturer and the healthcare provider) and is consistent throughout the healthcare supply chain (including distributors and providers). This is directed by the nonprofit standards organization GS1 under the "GS1 Healthcare" program name.

Position and Adoption Speed Justification: Progress in GS1 Healthcare standards is measured in this Hype Cycle by the series of steps necessary for adoption of the GDSN in the U.S. Although other countries — most notably, Australia with national adoption — have provided early leadership in this area, the U.S. market's size and influence mean that virtually all the major life science firms are actively engaged in the U.S. effort. In addition, with a largely private (versus government-owned) healthcare delivery system, the U.S. represents the whole array of challenges (including IT-related) that any national adoption effort is likely to face.

GS1 Healthcare has made good advances in the past year. It continues to gain endorsement and participation among the key stakeholder groups, including health systems, group purchasing organizations (GPOs), suppliers, distributors, ERP/supply chain application vendors and associations. In April 2013, GS1 announced that it had garnered endorsement of the GS1 System of Standards in healthcare from 40 leading entities — including manufacturers, distributors, GPOs, governments and health systems across the U.S., Canada, Europe, Australia and Japan. The list includes health system-owned Premier and Novation GPOs, and the Department of Health U.K. for all National Health Service hospitals (for a full list, see www.gs1.org).

Another significant factor in adoption is related action by the U.S. Food and Drug Administration (FDA) to establish a rule (which Congress had directed it to do in 2007 legislation) that most medical devices distributed in the U.S. carry a unique device identifier (UDI). The FDA cited its benefits in improving the quality of information in medical device adverse event reports and improving patient safety by helping the FDA identify product problems more quickly and more effectively target recalls.

The Global Harmonization Task Force, a voluntary group of representatives from national medical device regulatory authorities and the regulated industry, supports these interests by encouraging international harmonization in the regulation of medical devices. Although this future use is not included in our assessment of GS1 Healthcare's position and adoption speed, the UDI is dependent on something like the GDSN operating, and UDI code would be according to ISO 15459 (issuing agencies GS1, Health Industry Business Communications Council and the International Council for Commonality in Blood Banking Automation). Interested parties should keep abreast of the pending/ overdue final rule from the FDA on the UDI and review of approximately 300 comments received. Note that GS1 Healthcare is part of the World Health Organization's International Medical Products Anti-Counterfeiting Taskforce (IMPACT).

An important endorsement occurred in April 2013 when the Healthcare Transformation Group (made up of Geisinger Health System, Intermountain Healthcare, Kaiser Permanente, Mayo Clinic and Mercy, which has been acting in support of GS1 standards for some time) announced the establishment of an R&D team of physicians and clinical researchers to advance the adoption of GS1 standards and jointly accelerate the health systems work to implement a UDI system. Their work includes establishing a standard language and network of datasets and an expansion of an FDA UDI demonstration project currently underway. The plan is to eventually provide a path for implementing UDI into each member's clinical processes, "tracking devices end-to-end from manufacturer to research database" (see http://healthcaretransformationgroup.com/backend/wp-content/uploads/2011/10/HTGNewsRelease-April2013-FINAL.pdf).

Use in transactions is modest but growing. GS1 has implemented readiness scorecards for helping the industry participants gauge progress. Progress is aided by the fact that stakeholders — particularly, international pharmaceutical, medical device and ERP companies — do not want to see the development of country-by-country standards. According to GS1, more than 70% of top companies, based on revenue, in pharmaceuticals and medical devices are prepared with Global Trade Item Numbers (GTINs) for their products. In the U.S., the Department of Defense has long been an active advocate, and the Healthcare Transformation Group is taking leadership, acting as a unit on this issue to set expectations for suppliers. The FDA is an active participant in the U.S. and global GS1 initiatives.

Nevertheless, such a comprehensive standards effort takes a long time. As a result, we have nudged GDSN's placement ahead slightly on this Hype Cycle. Gartner still projects that GS1 Healthcare GDSN's general adoption will be in the five- to 10-year range because of the interdependencies required for benefit capture. There are those who doubt whether the standard can be adopted without further U.S. federal government mandate. However, the 2013 through 2015 period will tell the tale, because accelerated adoption is anticipated due to serialization deadlines, the government initiatives, the drive for efficiencies and improved patient safety in the industry,

provider organizations getting past other key initiatives, and the level of individual company preparations.

Adoption Steps

Healthcare stakeholders, including healthcare providers and life science companies, have adoption plans designed to leverage the set of GS1 Healthcare standards — promising significant efficiencies in global commerce. The standards include the GTIN for identifying all products globally, the Global Location Number (GLN) for identifying locations and the GS1 Data Quality framework. The GS1 global registry and GS1-accredited certification organizations are used to ensure conformance with the standards. GDSN is used to represent the completed process of synchronizing item and location data across trading partners. These standards and processes form the foundation for ensuring consistency and eliminating inefficiencies in product ordering, returns, recalls, pricing, contracting and the many other processes that rely on trading partners having the same information.

Additionally, there are standards for product traceability (Global Traceability Standard for Healthcare) and product coding (GS1 bar codes and Electronic Product Code-enabled RFID tags, which enable automatic data capture of the GTIN). Although the economic benefit and significant support for GS1, in general, bode well for strong uptake over time, changing the coding systems used for interorganizational information exchange requires coordinated IT changes that impact not only communications, but also internal applications that will need to evolve slowly to be cost-effective.

Establishment of the GDSN began with GLN and GTIN in the U.S. Here are the steps relevant to the positioning and speed of GDSN adoption:

1. GS1 GLN standard for location identification in 2010. Adoption of the GLN facility location standards means the following: GTINs are assigned to healthcare products, and GLNs are assigned by location owners. GLNs are used in appropriate business transactions and processes between trading partners, and the GLN hierarchy is defined and maintained by location owners. GLN Registry for Healthcare is used to facilitate correct location identification.
2. GS1 GTIN standard for product identification by year-end 2012, which means the following: GTINs are used in business transactions, are marked on appropriate packaging levels, with GTINs scanned at points of delivery to enhance clinical processes, and used in product returns and recalls. With these first two steps implemented, the use of a certified GS1 GDSN data pool becomes possible and expected for commerce.

User Advice:

For healthcare delivery organizations (HDOs):

- VPs for supply chain management (SCM), CIOs and ministries of health and drug regulatory bodies should actively support GS1 Healthcare. Participate through working groups or pilot programs. Encourage regional, rather than country-by-country efforts, where it makes sense and can be governed and managed.

- For HDOS in the U.S., follow leading HDOs, such as Mayo Clinic and Mercy. Formally inform supply chain partners of your intent, and plan for internal readiness.
- For CIOs, it's time to introduce the discipline of master data management (MDM) and related tools and processes into your health system. GS1 healthcare and product data is one area where you're getting a lot of help, but where having effective item master and charge master systems and updating processes in place are very important to operations and to revenue. Actively plan for GS1 standards by collaborating with your supply chain executives, who should also be early advocates of the MDM approach once they understand what it is. Ensure that your ERP/SCM vendors can support GS1 Healthcare standards (most are involved with GS1 by now).
- Keep a lookout for potential SCM breakthroughs and new regulatory requirements, particularly from the U.S. FDA (and multiple countries' anti-counterfeiting initiatives) related to these standards. Public and/or private payers in many countries are demanding further control of HDO operating expenses, and CEOs are looking for breakthroughs that generate major reductions in total supply chain costs. GS1 is not the only step required to achieve patient safety or logistical benefits, but consistency and reliability of data are critical components to progress. GS1 is helpful in efforts to standardize physician preference items across the enterprise. HDOs will require equipment, applications, policies and procedures, and mapping to EHR systems to take advantage of these standards.

For life science organizations:

- Leverage foundational ERP capabilities and MDM efforts for incorporating these standards. Consider the implications for aligning data in downstream channel transparency efforts, as well as for applications in controlled distribution situations, such as Schedule II controlled substances or products subject to risk evaluation and mitigation strategy programs.
- Ensure a strong foundation of MDM data for customers and products before embarking on these efforts. Success will depend on quality data and data that is accurate and maintained properly.

Regarding the FDA Global Unique Device Identification Database (GUDID) initiative, for all parties, including EHR and ERP/supply chain-related software vendors:

- Keep tabs on the U.S. FDA's GUDID requirements and UDI system timetable, and the implications of its mandates for your organization/IT systems.
- Inventory all systems in which such data will need to be stored and accessed to develop an IT plan.
- Consider how to leverage the UDI to improve the quality of information in medical device adverse event reporting, better manage product recall, aid in counterfeit detection, and other patient safety initiatives.

Note that other countries are pursuing similar initiatives or planning to adopt the FDA approach.

Business Impact: Supply chain can represent 20% to 25% of an HDO's operating expense. It's a challenging area to manage, so breakthroughs in SCM are welcome. Just creating and/or managing proprietary product numbers and data cleansing take significant resources.

For life science companies, GDSN provides a critical means of aligning many disparate data sources found between their organizations and end consumers. It's also an enabler for innovation in channel transparency and analytics. For example, the FDA's interest from a patient safety and product recall standpoint is driving the universal medical device identifier at an individual device packaging level. Preventing counterfeit drugs is also a high priority in many parts of the world. Both of these are enabled by GS1 standards.

As life science companies, ERP/supply chain management vendors, health system executives and government officials dive deeper into GS1 Healthcare's potential, they see benefits in terms of major re-engineering of supply chain processes/relationships, directing patient safety/medication error investigations, product traceability, confirmation of proper sterilization and anti-counterfeiting needs, and even assistance in collaborative, international clinical research/effectiveness research. Standardization and interoperability are also of invaluable societal benefit when medical supply logistics must be coordinated among governments and relief organizations. It seems that, every year, we are reminded of the need for urgency, efficiency and international cooperation in the delivery of medical supplies during natural disasters or a pandemic. And every year, we have examples of either serious drug counterfeiting or dilution problems affecting both developing and developed nations.

We rate the ultimate benefit of this standard high because of all the areas and stakeholders that the suppliers and these standards touch. Value will ultimately be defined by how businesses realign to achieve economic and competitive benefits based on leveraging the availability of vast amounts of comparable data.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: 1SYNC (Data Pool); GHX; GS1; GS1 Australia; GS1 China; GS1 Healthcare US; GS1 UK; LANSA

Recommended Reading: For more information on global and U.S. GS1 activities, as well as various country case studies, see www.gs1.org and www.gs1us.org/sectors/healthcare.

Desktop Virtualization

Analysis By: Zafar Chaudry, M.D.

Definition: Desktop virtualization is commonly referred to as hosted virtual desktop (HVD); it is a form of server-based computing. HVD moves a "thick client" PC image from a remote location to the data center, where it becomes a server workload. It includes server virtualization software to

host desktop images; a session management layer to connect users to their desktops; and tools to provision, monitor and manage the HVD environment.

Position and Adoption Speed Justification: Unlike server-based computing (SBC), characterized by Citrix XenApp, in which each application is "published" and its presentation layer is sent to the remote device separately, the presentation layer for the entire thick-client image is sent to the remote device. Access to an HVD can be through a browser on a PC, on a mobile device or via a thin-client device, and all processing occurs on the host server.

An HVD runs in a virtual machine (VM). Multiple VMs can run on each server, with each VM hosting a PC OS and its associated applications. Because of persistent Windows deployment issues associated with the thick-client workstation requirements of many of the major clinical vendors, as well as remote-access requirements, most healthcare delivery organizations (HDOs) are familiar with the concept of the virtual desktop. HDOs are considering a complete transformation of their desktop environments, and many are finding HVD to be a good fit to their business problems of clinical mobility and delivery. With the continued automation of the HDO clinical IT environment, particularly the increased introduction and continued optimization of electronic health records (EHRs), this technology can empower their users, simplify the overall management and increase the ability to secure their environments.

Virtualization technology can also enable HDOs in their ongoing efforts to make their fixed and mobile client-computing environments more manageable, reliable and secure. Right now, the total cost of ownership (TCO) for an HVD is estimated to be no lower, or only slightly lower, than that of a conventional desktop PC. Infrastructure costs, licensing considerations, staffing and operational overhead will present challenges to HVD deployments. Because of these concerns, despite increased interest, HVD has moved only slightly ahead of last year's position on this Hype Cycle.

Traditionally, healthcare has been viewed as a vertical that is slow to adopt new technologies, but for HVD technology, according to Gartner's HVD worldwide forecast, healthcare is one of the fastest-growing market segments for virtual desktops. Many Gartner HDO clients are actively investigating HVD or have pilots ongoing. HDOs should allocate ample planning time before implementation to avoid rushing into HVD deployments, without considering the broader infrastructural issues. HDOs need to consider the infrastructure requirements of supporting an on-premises implementation or the advantages of remote, hosted services offered by HVD vendors and their partners.

Although not fully mature, HVDs are already a viable technology for some users and scenarios — particularly clinicians who require the ability to move from desktop to desktop without losing their session information (for example, in the emergency room or ICU). HVD, combined with thin-client workstations, will be attractive in the patient room — where noise and heat can be minimized with these technologies. HVD is also lucrative when an HDO devises desktop refresh plans (that is, desktops can have longer refresh cycles when using HVD). Issues surrounding software licensing and TCO must be understood. The dynamic deployment nature of HVD makes it easy for customers to breach concurrent user license agreements. It is imperative that IT understands license agreements fully and complies with them prior to HVD deployment.

User Advice: HVD remains obfuscated by vendor claims with regard to issues such as cost, management, scalability, performance and user experience. Ensure that any decision to change the client-computing architecture is founded on a thorough and complete evaluation of costs surrounding testing, integration, product certification, storage, network and other infrastructure elements. Entry costs, infrastructure dependencies, licensing considerations, staffing and operational overhead present challenges to HVD deployments. Although HVD is technically viable now, we recommend that most organizations pilot HVD for selected users before starting deployment for mainstream users.

Also, devise robust business cases that clearly articulate the TCO and ROI for this technology, since the ROI will probably not come in reduced hardware costs alone. HDOs need a clear understanding of users, applications and manageability requirements before HVD deployments begin in earnest. Be realistic in planning which users will be supported through an HVD. Start with structured-task workers, and plan to expand to knowledge workers. Define the responsibilities of desktop, end-user computing and data center staff before beginning HVD deployments. Ensure that full production requirements for server, storage and network infrastructure are factored into pilot deployments of HVDs. There will also be a need for substantial expertise in the design and deployment of an HVD server farm. IT staff training to support the deployment and ongoing management is also important. The transition from physical to virtual desktops is not a simple one.

The growing influence of user choice is forcing HDOs to find solutions that increase the flexibility of access to Windows-based HDO content. HVD can also help HDOs embarking on a bring your own device (BYOD) program. HVDs provide a versatile way for IT to securely deliver a Windows desktop to different end-user platforms, but at a cost. To successfully embrace BYOD programs, HDOs must also address process and organizational behavior, as well as other technology requirements. Vendors like Citrix and VMware are promoting their respective products (XenDesktop and VMware Horizon View) as an alternative to the mobile device management (MDM) approach. Use HVD to enable BYOD, where users leverage PCs, Macs or mobile devices to access a hosted corporate image, but understand the limitations of HVD. Adapt the corporate network security infrastructure, and investigate strong authentication solutions when giving unmanaged devices access to centralized applications and data. Balance the likely increase in cost against labor reallocation opportunities and benefits in delivering a more flexible working environment for your users.

Cloud-based HVDs are another option, where an external vendor provides the HDO with a desktop, as well as the infrastructure to host, manage and support it. Cloud-based HVDs are provided at a fixed cost, so there are no additional costs for upgrades or hidden support fees. Cloud-based HVDs include options for hosted office productivity software (for example, Microsoft Office); cloud storage; hosted email applications (for example, Microsoft Exchange); and access from any device, including PCs, Macs, iPads, iPhones and Android devices. However, HDOs have very specific requirements for electronic medical records, clinical applications, data security, reliability and availability for both their desktops and applications. So, carefully consider the vendor's offering to ensure it complies with data security requirements best practices, as well as has HIPAA and HITECH certifications.

Business Impact: HVD is another way to deliver a rich desktop experience. So, it will coexist with conventional PCs and server-based computing for some time to come. Single sign-on (SSO), strong

authentication and HVD have found synergy — collectively providing a seamless authentication and access experience for clinicians in HDOs that have chosen to combine these technologies.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Citrix; Dell; Desktone; HP; IBM; Microsoft; MokaFive; NComputing; Oracle; Red Hat; Unidesk; Virtual Bridges; VMware

Recommended Reading: "Hosted Virtual Desktop Organizational Models"

"Citrix XenDesktop and VMware View Are Vying for Your Hosted Virtual Desktops"

"Field Research Results: Desktop Virtualization in the Healthcare Industry"

"Decision Point for Desktop Transformation: Virtual, Physical or Server-Based Computing?"

"Security Considerations for Server-Hosted Virtual Desktops and Server-Based Computing"

"Virtual Desktop and Application Delivery"

Mobile Device Management

Analysis By: Barry Runyon

Definition: A mobile device management (MDM) platform provides for the software, hardware, security and network service management of smartphones and tablets within the enterprise. MDM systems can help healthcare delivery organizations (HDOs) expand the use of mobile devices in the workforce, moving toward an environment in which both enterprise-furnished and employee-owned devices can coexist in a secure and controlled environment.

Position and Adoption Speed Justification: For some time now, healthcare providers have recognized that mobility can contribute to streamlined and collaborative business processes and timely access to protected health information (PHI) and medical knowledge. Devices are regularly moving closer to the point of care, and mobile devices are being used to extend the reach of expensive and critical clinical and business systems. With handheld devices like smartphones and tablets (media and mobile clinical assistant [MCA] devices), the clinician no longer has to rely exclusively on a stationary workstation to retrieve patient information or medical information. With increased coverage, security and integration, wireless has had a profound effect on how and where care is delivered.

If anything is alien to the IT organization, it is the bring your own device (BYOD) movement. Despite that, HDOs have begun to embrace BYOD as a way to satisfy end-user IT requirements. BYOD brings with it the need for new application and security architectures, new management and support policies, and new expense processes. The demand to use personally owned devices within

the HDO comes from digital natives, upper management and clinicians. Physicians are at the forefront of this phenomenon. They have a real need and desire for mobile devices, software and tools that enable them to conveniently and safely communicate and collaborate and to improve their productivity and care quality. They look to IT to ensure this activity is convenient, secure and responsive.

The HDO IT organization is routinely beset by an array of regulatory, compliance, security, technology, expense, organizational and policy constraints that limit its ability to respond to the BYOD trend. The rate of innovation in smartphones, media tablets, social media and mobile applications is much faster than the enterprise adaptation rate. As more-useful mobile clinical applications surface, and as HDO users begin to rely more heavily on mobile computing, MDM will become a requirement.

User Advice: HDOs already manage laptop PCs and notebooks similarly to managing desktop PCs; however, the needs of tablets and smartphones must be more closely assessed. The use of smartphones and media tablets should be governed by the appropriate mobile device policies. Put in place a mobile device policy that sets forth all of the mobile devices affected by the policy, acceptable-use guidelines, responsibilities of users and the enterprise, and any associated penalties and corrective actions. An MDM platform will be necessary to support the move toward a choice-oriented approach.

HDOs must consider how the support organization may be affected by a BYOD policy. What should the HR organization do to prepare for a BYOD approach? For example, do new employees need to sign an acceptable-use policy, or do all employees need to undergo security training? Should some mobility-related functions be outsourced? It may make sense for some HDOs to take a cloud-based MDM approach (for example, using AirWatch, Fiberlink and Good Technology) or to outsource the mobile expense management function (for example, using Tangoe and IBM-Emptoris). Begin the necessary planning and infrastructure investments to retire in-house and/or wide-area pagers for clinicians, in favor of smartphones.

Business Impact: Not all HDOs are convinced that BYOD access is advisable at this time, given the lack of enterprise preparedness and the host of privacy, security and administrative challenges. Those embracing BYOD, even reluctantly, are looking to IT to provide a secure, manageable and responsive mobile computing environment. Before implementing a BYOD program, determine if your IT infrastructure and support services can accommodate the anticipated number of employee-owned mobile devices and system access requests.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: AirWatch; BMC Software; BoxTone; Fiberlink; Good Technology; McAfee; Microsoft; MobileIron; Sybase; Zenprise

Recommended Reading: "Critical Capabilities for Mobile Device Management"

"Magic Quadrant for Mobile Device Management Software"

"Competitive Landscape: Mobile Device Management Market, 2012"

"Top Actions for Healthcare Delivery Organization CIOs, 2013: BYOD by Design"

Vendor-Neutral Archive

Analysis By: Barry Runyon

Definition: A VNA provides for a single, enterprisewide repository of patient-centric medical images. Vendor neutrality is achieved by interfacing with all major PACS vendors via DICOM and HL7, and accommodating proprietary PACS considerations for medical image storage, retrieval and viewing. The VNA value proposition centers on promoting medical imaging standards, increasing the control and ownership the HDO has over its medical images and associated data, mitigating data migration complexity, and decreasing its dependence on individual PACS vendors.

Position and Adoption Speed Justification: The vendor-neutral archive (VNA) enables centralized access to the patient images for historical comparison, for second opinions and consultations, and for the integration with electronic health record (EHR) systems and health information exchange (HIE) purposes. The VNA has been alternatively referred to as the "enterprise image archive," a "Digital Imaging and Communications in Medicine (DICOM)-neutral archive," a "picture archiving and communication system (PACS)-neutral archive" and an "application-neutral archive." Whatever the term, in all cases, the goal has been to achieve neutrality and a certain degree of independence from the PACS vendors' proprietary interests. "VNA" has surfaced as the most popular appellation to date.

There are basic principles and characteristics that define a VNA, such as the ability to interface with all major PACS and clinical systems via DICOM and Health Level Seven (HL7), and the ability to store images in a nonproprietary DICOM format. VNAs are partly a response to prodigious storage growth due to medical imaging, and the onerous cost and complexity of PACS-to-PACS migrations. Genuine interest in VNAs among healthcare delivery organizations (HDOs) began in 2009. Since then, HDOs have begun drafting enterprise imaging strategies that include the evaluation and selection of a VNA platform. Government regional efforts (HIEs in the U.S., Canada, Europe and Australia) to create cross-enterprise centralized image repositories are further along than HDOs. With a significant portion of the electronic medical record dependent on unstructured data, the trend will be toward getting more value out of imaging metadata to improve patient outcomes. HDOs will begin to invest more aggressively in VNAs as replacement PACS come online, and as these images need to be shared outside of their departmental silos. Barriers to VNA adoption include concerns about initial licensing, data migration complexities and costs, the security of cloud-hosted models, performance and availability, support for existing storage fabric, and reporting deficiencies.

User Advice:

- Deploy a VNA as a component of a larger information life cycle management (ILM) strategy.

- Offload aging studies to improve the performance and availability of the departmental imaging systems, and to facilitate PACS decommissioning and PACS-to-PACS migration.
- Select a VNA vendor that has experience integrating with your particular EHR system, and one that can leverage your existing storage fabric.
- Choose a VNA vendor that can provide intelligent data cleansing and migration services from your existing PACS systems or has partnered with an imaging data migration specialist.
- Opt for a VNA platform that can store and manage non-DICOM objects, such as conventional image files, and one that has a strategy for accommodating images from less obvious sources, such as endoscopy, ER (wounds) and ophthalmology.
- Pick a VNA that supports Medical Imaging Network Transport, a new technology designed to improve access speed for the display of medical images.
- Select a VNA that supports IHE's Cross Enterprise Document Sharing Profile (XDS), particularly the XDS-I capability for existing PACS. In the final rule for Meaningful Use, Stage 2, there is a "menu" measure that requires that more than 10% of all scans and tests that result in one or more images be accessible through the EHR. Individual eligible physicians and hospitals will come under this mandate between 2014 and 2017. A VNA can make it easier for HDOs to satisfy this requirement.

Business Impact: A VNA can stem the proliferation of proprietary, departmental archives and viewing solutions across the HDO. By centralizing enterprise image storage to a single, sometimes remote, scalable repository, it can also improve the HDO's disaster recovery posture. By routinely offloading aging studies, it can improve the performance and availability of individual departmental PACS. A VNA can facilitate PACS decommissioning and PACS-to-PACS migration efforts by eliminating vendor-specific DICOM header information and storing the medical images in a vendor-neutral manner. A VNA frees up HDOs to purchase best-of-breed imaging solutions. A VNA is an important component of an ILM strategy, and can facilitate image exchange between healthcare facilities or HIEs. Diagnostic-quality images can be shared with DICOM-compliant PACSs with the proper level of patient detail.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Sample Vendors: Acuo Technologies; AT&T; BridgeHead Software; Carestream Health; Cerner; DeJarnette Research Systems; Dell; Dicom Systems; DICOM Grid; GE Healthcare; GNAX Health; Laitek; Mach 7 Technologies; Merge Healthcare; TeraMedica

Recommended Reading: "The Rise of the Vendor-Neutral (Image) Archive"

"Move From Document Management to Enterprise Content Management"

"Lexmark's Acquisition of Acuo Technologies Heralds a New ECM Focus for HDOs"

"Technology Overview for Medical Image Intake and Sharing"

"Technology Overview for Vendor-Neutral Archives"

Climbing the Slope

Information Life Cycle Management

Analysis By: Zafar Chaudry, M.D.

Definition: Information life cycle management (ILM) is an approach to data and storage management that recognizes that the value of information changes over time and that it must be managed accordingly. ILM seeks to classify data according to its business value and establish policies to migrate and store data on the appropriate storage tier and, ultimately, remove it altogether. ILM has evolved to include upfront initiatives like master data management and compliance.

Position and Adoption Speed Justification: ILM is not a single product or technology, but rather, a number of related concepts, policies and technologies. Most data management, storage management, content management, document management and records management systems fall under the ILM umbrella. The main drivers of ILM are enterprise data growth, growth in unstructured data, and information access and security concerns. Challenges in instituting ILM include the high cost and complexity of the storage management environment; lack of standards, leading to confusion in the marketplace; and required upfront investments in data, application and storage hardware.

However, ILM advocates that, by routinely modifying the storage used and the levels of protection throughout the life cycle of information, organizations can lower the total cost of ownership (by eliminating redundancies in data storage), better achieve compliance (thereby minimizing business risk), and improve availability by aligning information with business goals and service levels. It enables the enterprise to organize and manage its structured and unstructured content and the associated storage infrastructure. The drivers for ILM within healthcare delivery organizations (HDOs) include clinical automation, medical imaging, compliance, business intelligence (BI) and legal discovery.

Although most major storage vendors have announced some type of ILM initiative, no consistent portrayal of ILM has surfaced, and HDOs remain confused about its value proposition. Vendors are attempting to reposition their established products into configurations they can market as ILM solutions, and this can add to the confusion. Nevertheless, HDOs have invested in ILM to varying degrees. They have established storage tiers; invested in storage resource management tools; and managed and archived some of their email, documents and medical images, based on data retention schedules.

The vendor-neutral archive and the enterprise content management system are part of an ILM strategy to manage storage growth and improve clinical access. However, it is still easier to purchase additional storage than to invest in a comprehensive ILM strategy. Better data

classification and storage management tools, along with advances in the vendor-neutral archive and storage virtualization, will make it easier for HDOs to adopt ILM as it moves only slightly beyond the Trough of Disillusionment, during which the real lessons are learned.

User Advice: HDOs should initiate ILM primarily through policy and people, not technology. Since the main drivers for ILM are storage-related issues associated with clinical automation, medical imaging, enterprise collaboration, compliance, BI and legal discovery, develop an ILM plan for your data that goes from initial storage to its ultimate deletion by conducting the following activities:

- Create a master data management (MDM) strategy that is closely aligned with the enterprise's business strategy.
- Identify important structured and unstructured enterprise data. Focus on information value and the processes used to extract value.
- Work with medical records, legal and other departmental data owners to establish data retention requirements. Focus as much on discarding information as storing it.
- Establish an overall storage and data management plan.
- Implement a tiered storage infrastructure.
- Create a formal storage management function or position within IT.
- Deploy storage resource management tools, search and automated classification software.
- Engage a storage professional service to improve storage utilization and to delay incremental storage acquisitions.
- Deploy an email archiving system, enterprise content management system and a database archiving solution for legacy decommissioning.
- Offload aging studies to an enterprise or vendor-neutral archive to improve the performance of departmental imaging systems, as well as to facilitate picture archiving and communication system (PACS) decommissioning and migration efforts.

HDOs should recognize that application-specific ILM implementations can disrupt enterprisewide initiatives, while the primary drivers of ILM must be compliance, legal discovery, risk management and data retention.

Business Impact: A business case for ILM gets stronger as more enterprise information accrues, along with the need to efficiently and cost-effectively archive and recover this information. Many HDOs lack a strategic approach for managing critical enterprise information through its life cycle and rely on out-of-date, operational contingencies. Often, data center backup schedules define the scope of their information life cycles and data retention strategies. This is, in part, due to the daunting level of effort that ILM implies and the integrated storage infrastructure it requires.

Although comprehensive ILM offerings are still years away, HDOs should begin to prepare for ILM now by exercising governance, classifying their data, observing industry data retention best practices, and enforcing data migration and archiving policies that will make the best use of their storage fabrics and ensure compliance.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: CA Technologies; Dell; EMC; Fujitsu; HP; Hyland Software; IBM; Informatica; Microsoft; NetApp; OpenText; Oracle; Perceptive Software; Symantec; Xerox

Recommended Reading: "Technology Overview for Vendor-Neutral Archives"

"Move From Document Management to Enterprise Content Management"

"The Seven Building Blocks of MDM: A Framework for Success"

"Use Best Practices to Improve Data and Storage Administrator Interactions"

"Top Actions for Healthcare Delivery Organization CIOs: Introduce Enterprise Information Life Cycle Management"

"Information Lifecycle Management"

NLP

Analysis By: Wes Rishel

Definition: Natural-language processing (NLP) technology provides the ability to extract encoded, structured information from natural language utterances (usually dictated text, but occasionally audio). The structured data may be used simply to classify a document, as in "this report describes a laparoscopic cholecystectomy," or it may be used to identify detailed findings, procedures, medications, allergies and participants.

Position and Adoption Speed Justification: NLP is distinct from speech recognition, in which audio is converted into natural language text. In clinical care, users of NLP primarily focus on partial semantic interpretation of dictated text to increase the productivity of people who are abstracting clinical information to support billing, quality measures and front-end research processes, such as hypothesis or cohort formulation. In these scenarios, the final decisions are left in the hands of people, rather than being made automatically based on NLP discernment of the content of reports.

NLP is also being used to index patient-specific data or the medical literature to support "smart searches" — that is, searches that make use of semantic equivalence or other semantic relationships to find relevant information. For example, a literature search in the context of a patient with a dictated note that describes using Lardil might trigger matches with articles about monoamine oxidase inhibitors.

The fundamental driver in health information management departments is to reduce, but not eliminate, the time spent by coders by making the critical text sections of relevant documents immediately accessible. These departments have pending changes in workflow associated with

ICD-10, and revised reporting requirements for meaningful use and accountable care. The analysis associated with changing workflows offers the ability to consider NLP-based products or add-ons, as well as compelling potential savings in labor and calendar time, so this usage is likely to grow.

Ideally, however, health information management departments would be even more productive if clinical data were first captured in structured form. NLP can be an important tool in achieving this ideal. This workflow is described more in the Computer-Assisted Documentation entry of this report.

In this year's Hype Cycle, we have narrowed the focus to NLP in enterprise clinical systems. Consequentially, we moved the position back because the technology is much less mature than it is in some departmental applications.

User Advice: When buying or upgrading systems that support abstracting charts, favor products that support the use of NLP. Involve users in evaluation, carefully evaluate the workflow and conduct pilots or mockups with the users to ensure that a specific package emphasizes the productivity of the people who will review and finalize the output. Other potential uses of NLP include accreditation of clinicians based on procedures performed and the investigation of the source of infections.

Business Impact: Increased productivity permits the encoding of substantially more information about clinical events and conformance to quality measures. This is increasingly necessary to "keep the wheels on" (that is, perform the ongoing business of health information management). Having more structured data ultimately increases the opportunity for healthcare delivery organizations (HDOs) to better manage healthcare processes, providing clinicians with much more immediate information to improve clinical processes and allowing management to react more quickly to changes in business situations.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: 3M Health Information Systems; Dolbey; Health Language; M*Modal; Nuance; OptumInsight

Recommended Reading: "The Evolving Model of Clinical Dictation and Transcription"

Location- and Condition-Sensing Technologies

Analysis By: Barry Runyon

Definition: Location-aware technologies include a range of approaches used to determine the geographical position of a person or thing. The most familiar is GPS. Other location technologies include infrared, RFID, ultrasound, ultrawideband, Wi-Fi and ZigBee. Condition-sensing involves using some of these same technologies to monitor temperature, humidity, light, movement and low-

battery situations associated with refrigeration devices, and hygiene compliance in areas within hospitals that require close monitoring.

Position and Adoption Speed Justification: Staff and medical equipment are in constant movement throughout the healthcare delivery organization (HDO). Both are often difficult to locate, and timely access is critical to the delivery of care, operational efficiency, compliance and the patient experience. Asset tracking is showing usage gains relative to more-precise inventory and maintenance management. Location- and condition-sensing technologies, combined with wireless healthcare asset management (WHAM), patient throughput and capacity management (PTCM), bed management and nurse call, can work together to provide the real-time intelligence necessary to increase compliance, protect assets, and balance scheduling, workload and resource demands. WHAM and PTCM are covered in the "Hype Cycle for Healthcare Provider Applications, Analytics and Systems, 2013."

Most HDOs have pervasive LAN/wireless LAN (WLAN) infrastructures in place, and have deployed a host of mobile computer and medical devices in support of clinical and business workflows. They are looking to leverage these infrastructures to improve care, reduce costs and manage workloads. Due to the surplus of hype in this space, and the overall immaturity of the market, HDOs are uncertain which location- and condition-sensing technologies are most appropriate for their enterprise use cases, or which vendors will survive market consolidation. HDO activity in this space will continue to be mired in the Trough of Disillusionment as HDOs sort out their requirements and ascertain vendor and product capabilities. Despite the confusion, HDOs increasingly see the value in "enterprise awareness," and have increased their adoption of location- and condition-sensing technologies.

There are concerns regarding the cumulative effect of these demands on the enterprise WLAN, which will create a corresponding interest in more-robust WLAN bandwidth management practices and tools. Because an increasing number of mobile devices include location sensing, HDOs should look for ways to improve their business processes by leveraging location-aware technology. This is necessary for efficient operations, to balance demand with resources, and for meaningful planning and decision making. The hospital as a "real-time healthcare system" requires up-to-date information to progressively remove delays, and for the optimal execution of its critical business and clinical processes.

User Advice: Use location- and condition-sensing data to optimize business and clinical workflows, improve patient throughput, and improve staff and equipment use. Identify critical clinical and business workflows that can benefit most from location- and condition-sensing services and underlying technologies. Understand the precision; technical limitations; and procurement, maintenance, integration and support costs associated with each of the various technological approaches. Consider combining technologies (for example, Wi-Fi or active RFID for larger enterprise monitoring, passive RFID for improving clinical workflow, or ultrasound for in-room sensing) while attempting to keep the overall design as simple and maintainable as possible. Take trade-offs into consideration, such as the ability to leverage existing LAN/WLAN infrastructures, coverage, battery life, precision, device interference characteristics and vendor application integration capabilities.

Business Impact: Location- and condition-sensing technologies — when used in concert with resource-tracking/monitoring systems and dashboards that make information and device information visible to the enterprise — make it possible to tame and leverage the increased mobility inherent in the modern HDO. Improved business process management is enabled by the analysis and the data collected from location- and condition-sensing technologies and systems. Combining them with WHAM, PTCM and systems such as nurse call will result in operational efficiencies, such as improved patient flow, compliance (for example, device maintenance), resource use and planning. Visibility into real-time location and/or condition intelligence will become increasingly vital to running an efficient and effective HDO. Workflow improvements resulting from location technologies, as well as associated information and systems, are incremental in nature and reduce costs through the introduction of efficiencies. Initial capital costs (WLAN improvements, access points, chokepoints, readers, mobile devices, integration platforms and so on) and implementation times (workflow requirements, application integration work and so on) can be significant and lengthy.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: AeroScout; Awarepoint; CenTrak; Cisco; Ekahau; Radianse; Sonitor Technologies

Recommended Reading: "Awareness Platforms Are Critical to the Real-Time Healthcare System"

"Four Questions Hospital Administrators Must Ask Before Implementing RFID Asset Management"

"Innovation Insight: ZigBee Provides New Wireless Mobility"

SNOMED CT

Analysis By: Wes Rishel

Definition: The Systematized Nomenclature of Medicine Clinical Terms (SNOMED CT) is the largest collection of medical concepts that is updated in a rigorous fashion. It is maintained by the International Health Terminology Standards Development Organisation (IHTSDO). This intellectual property is a necessary prerequisite to creating clinical functions, such as documentarian and decision support. The standard reduces the burden of implementing electronic health records (EHRs) and enhances interoperability among them.

Position and Adoption Speed Justification: IHTSDO content development is funded through voluntary subscription by national governments. SNOMED CT is licensed to 22 member countries and to individual healthcare organizations in other countries. SNOMED CT contains a large variety of clinical concepts. Each concept is identified by a SNOMED CT code. Each concept is also described by natural-language descriptions. There may be more than one representation in a single language, such as heart attack, myocardial infarction and MI. IHTSDO and its members have produced full or partial translations in English dialects, as well as Spanish, Danish, French,

Lithuanian and Swedish. IHTSDO has also approved research and evaluation-scale translations into Portuguese and Polish. IHTSDO members also plan to translate SNOMED CT into other languages.

In addition to cross-indexing multiple codes and natural-language terms, SNOMED CT also provides links that implement hierarchies that represent some aspects of medical knowledge. For example, apoptosis is a morphologically altered structure that, in turn, is a body structure.

Our positioning is based on the use of SNOMED CT as a common code set across EHRs in English-speaking countries that are members of the IHTSDO. In countries that are not IHTSDO members or need natural-language representations that are not yet available, we would position it slightly pre-Trough of Disillusionment. At the same time, we believe that no separate effort will match the comprehensive nature of SNOMED CT, and many other countries will ultimately take up the use of SNOMED CT.

SNOMED CT has received considerable attention as a basis for interoperability among EHRs, where it is showing progress. For example, in the U.S., the rule for incentives under the Meaningful Use program requires the January 2012 release of SNOMED CT to communicate problems, lists, certain data sent to cancer registries and select other data, including specialized laboratory findings and in the definition of most clinical quality measures. In the U.K., SNOMED is in use in the national Choose and Book, and Summary Care Record projects.

However, these advances are either planned for next year or were accomplished last year. For this reason, we have held the positioning where it was last year. As additional U.S. usage becomes required in 2014, and as we observe progress, we expect to further advance SNOMED CT adoption and move it along the Hype Cycle. In anticipation of this, we have reduced the time to adoption to five years.

However, this adoption will not be without the difficulties that are typical when a specialized technology is rolled out for wide use. While it is frequently specified as the terminology for data interfaces between EHRs, it is less popular as the coding system to support the user interfaces within EHRs. The natural-language expressions of SNOMED CT are often not the most comfortable for clinical users, so EHR vendors or user sites often use in-house-developed concepts and expressions or buy them from third-party vendors, such as Intelligent Medical Objects. Furthermore, there remain third-party sources of terms that are not entirely compatible, such as RadLex, which is maintained by the Radiological Society of North America. Finally, EHR user sites are often faced with requests to configure the systems with terms that are not available on SNOMED CT or where it is not clear. Rather than submitting the concept to IHTSDO and waiting for a new release, the IT staff must produce a local code and include it in their own tables. These issues combine to create a situation where individual implementations of an EHR have different concepts or different codes for the same concepts. For data exchange, the data formats must allow for sending this exceptional data, even as the vast majority of the data can be expressed in SNOMED CT by one system and understood by the other.

The challenges we've described are very common as any technology moves through the Trough of Disillusionment. The value of having standardized codes, however, will ultimately outweigh the

difficulties, and the critical mass of concepts compiled in SNOMED CT will ensure that it is the primary vehicle for interoperable concepts.

User Advice: Healthcare delivery organizations (HDOs) have two options when configuring EHR features, such as documentation templates, clinical decision support, outcome analysis, care management protocols, semantic information exchange and evidence-based medicine literature references. The options are to use a set of codes that are developed locally or provided by the EHR vendor. HDOs newly installing clinical software should choose SNOMED CT. Increasingly, these codes are provided by clinical software vendors. This often streamlines software implementation. However, even if it does not, it prepares the HDO for semantic interoperation with other HDOs and healthcare stakeholders. Cross-enterprise interoperation is a necessary enabler of care management, research and quality measurement.

SNOMED CT is updated through regular releases. Care delivery organizations (CDOs) must budget for the analysis and other informaticist work necessary to install the updates. Fortunately, the updates are incremental. Existing codes remain valid, and new codes almost never supplant old ones. The amount that must be budgeted is far less than that for converting from ICD-9 to ICD-10.

Avoid using SNOMED CT codes and their natural-language descriptions directly in user interfaces. Instead, choose "interface vocabularies," and translate to SNOMED CT for interoperability.

Business Impact: EHR system interoperability, outcome analysis, error reduction, business process management and clinical decision support are all enabled and improved by using SNOMED CT.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Sample Vendors: 3M Health Information Systems; Apelon; IHTSDO; Intelligent Medical Objects; Medicomp; National Library of Medicine; Nuance; Wolters Kluwer

Recommended Reading: "Modifying the Enterprise CPR System Generation Model"

IHE XDS.b

Analysis By: Wes Rishel

Definition: The Integrating the Healthcare Enterprise (IHE) (see www.ihe.net) Cross-Enterprise Document Sharing (XDS) entry deals with a collection of standards and implementation guidance that is frequently used for health information exchange (HIE). XDS.b includes a set of profiles for operating a secure HIE that enforces privacy constraints. Under XDS.b, the unit of exchange is a report, which may include structured data. Exchanges happen by "lookup and retrieve," rather than "push."

Position and Adoption Speed Justification: IHE establishes integration profiles and specifications that identify standards, as well as defines how they will be used to meet specific interoperability challenges. System developers then develop code to match and test their interoperability at IHE-run "Connectathons" in North America, Europe and Asia/Pacific. Next, vendors describe their conformance to specific profiles in IHE conformance statements, a standard document format defined by IHE. IHE also conducts elaborate demonstrations of the interoperability of participating system developers at tradeshows, such as those sponsored by the Healthcare Information and Management Systems Society (HIMSS) and the Radiological Society of North America (RSNA).

We measure XDS market penetration by the degree to which its profiles have become the basis for actual integration in and among healthcare enterprises, or been used as a basis for contracts between healthcare organizations and healthcare IT vendors. Actual usage lags other indicators of IHE progress, such as the number of profiles or the number of vendors that have demonstrated conformance to a profile. Nonetheless, this is the measure that is most relevant to healthcare delivery organizations (HDOs).

XDS.b is referenced in numerous settings. Three that have become popular are general usage to interconnect electronic health records (EHRs) to form an HIE, Cross-Community Access (XCA) for inter-HIE connections and XDS-I.b for image sharing.

Many HIEs and HDOs report that they are in production using profiles built over XDS.b, including, but not limited to, XDS-I.b. These HIEs are concentrated in the U.S., the U.K. and the Netherlands, with a few in other European countries and Japan. Most of these are listed at "Where in the World Is CDA and XDS" (see www.google.com/maps/ms?ie=UTF8&oe=UTF8&source=embed&msa=0&msid=110535847732151766411.00047b0b46314e91435c9).

In the U.S., many EHR vendors are interoperating with one another on behalf of clients, using profiles built over XDS.b. The protocols may be used in a bilateral arrangement between vendors or may be operated as part of the Healtheway eHealth Exchange. Healtheway (see http://healthewayinc.org) is a private, nonprofit organization that provides the governance function for what was previously known as the Nationwide Health Information Network (NwHIN) Exchange. It is funded through membership fees. As of May 2013, Healtheway listed 39 participating organizations, including the U.S. Department of Veterans Affairs, the U.S. Department of Defense, Kaiser Permanente, other integrated delivery networks and a number of HIEs.

The XDS.b specifications are broad enough to support a variety of options with respect to whether repositories are centralized, federated or are actually the clinical systems that are data sources. It is still the case that there are disagreements among the vendors on how to interpret specifics of XDS, so a vendor needs to employ one of several interfaces, according to who the other vendor is.

The success stories for XDS.b have grown considerably in the last year, resulting in our moving IHE XDS.b further along the Hype Cycle.

It must also be noted, however, that two vendors that are HIEs may interoperate well enough to get documents from one source to another, but they frequently do not interoperate well enough to

transfer very much structured data between them. The replacement of the current HITSP C32 specification with the C-CDA and Meaningful Use certification may improve the semantic interoperability as new versions of products are rolled out to clients between 2014 and 2017. The C-CDA is described in this Hype Cycle.

In an ideal world, conformance to XDS would reduce the ability of the largest EHR vendors and their clients to control the sharing of data, at least to the extent that technical barriers and implementation costs limit such interoperability. The current situation in the U.S. market, however, doesn't support that premise. Even if semantic interoperability were to reach the levels anticipated in the Stage 2 Meaningful Use regulations, they would not begin to cover the wealth of structured data that can be shared within an EHR.

User Advice: HDOs that are establishing or participating in formal HIEs should use the XDS.b protocols for workflows that are based on query and response, providing that the key vendors the HDOs use have IHE support in their generally available software releases. Where workflows call for "pushing" information point to point, HDOs should use the protocols of the Direct Messaging, which is also described in this research.

XDS.b is only one technical component in the much bigger effort of creating an HIE. HDOs will need to assemble and get agreement on specific profiles built over XDS.b and create a contract among all participants covering operational approach and privacy protections.

Business Impact: Where the IHE approach fits HIE needs, using the IHE may reduce the time and risk associated with implementation.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Sample Vendors: Allscripts; CareEvolution; Cerner; e-MDs; Epic; GE Healthcare; Greenway; IBM; Infor; Intel; McKesson; Meditech; Misys; Philips Healthcare; Siemens Healthcare

Recommended Reading: "Without Profiler-Enforcers, Healthcare IT Standards Cannot Enable Interoperability"

"Technology Overview for Vendor-Neutral Archives"

Patient Portals

Analysis By: Thomas J. Handler, M.D.

Definition: Clinical patient portals enable a secure online patient-provider relationship and access to clinical and educational information as well personal health maintenance tools. They also include nonclinical functionality. Portals can be stand-alone or tethered (integrated) to electronic health record (EHR) systems or healthcare megasuite (e.g., clinical as well as financial, patient access) offerings.

Position and Adoption Speed Justification: Improved patient engagement remains a critical need for healthcare organizations. A patient portal is used by many healthcare delivery organizations (HDOs) to accomplish this end as a patient portal. Ultimately, a patient portal should encompass clinical and nonclinical functionality. Most of the stand-alone portals are a combination of these sets of functionality. As tethered portals mature, they will no longer just be linked to EHRs, but will become tethered to megasuite vendors' offerings that include clinical, financial and administrative functionality. These portals can encourage greater patient involvement and better patient/provider communications. The best patient portals are designed to benefit the HDO as well as the patient, and can build loyalty between the two. Patient portals should focus on:

- Making care more convenient by offering services such as online portal enrollment, appointment scheduling options, access to payer/plan eligibility and coverage information, prescription renewal/refill requests, preregistration functionality, referral requests and self-payments
- Improving the patient experience by offering patient/provider secure messaging, e-visits for nonacute healthcare issues and mobile support for those devices they commonly use
- Supporting health and wellness by providing timely access to lab and test results, medical decision aids, reviewed medical content, and communities of interest
- Providing support and tools for the patient's support network: family, close friends and unlicensed caregivers

In the U.S., the importance of a patient portal has been emphasized by being added to the meaningful use Stage 2 criteria. Ideally, a patient portal will include both clinical and nonclinical functionality; although, until recently, more attention had been paid to the somewhat easier-to-deliver nonclinical functionality. Positioning of this technology reflects the situation in the U.S. It's the country most advanced in using patient portals, and emphasizes the clinical functionality of the portals. In other countries, government health ministries are the main driving force behind patient portals. The primary form of patient portal outside the U.S. is a regional or national system that provides patients with access to a summary of their medical data and recent interactions — that enables them to renew prescriptions, book appointments and have e-visits. Examples of countries and regions that have pioneered patient portals include Denmark, Estonia, Sweden, Andalusia (Spain) and Lombardy (Italy), the U.K. and Australia.

Today, many U.S. enterprise and ambulatory EHR system vendors provide or are building a clinical portal that can be used to provide patients with access to their test results. Some vendors provide additional functionality that can be used for more provider-patient interactions — for example, secure communication, prescription refill/renewal requests, e-visits, lab and diagnostic test results, medication lists and patient education. While patient portal technology is mature, usage remains limited, with only a few leading HDOs effectively leveraging their vendors' patient portals to improve care and patient satisfaction.

Drivers for patient portals include rising healthcare consumer expectations of digital connectivity with their providers, efficiency benefits (especially for HDOs that are paid per patient), and, likely, reimbursements for e-visits, and, in some countries, political pressure on governments to make

visible improvements to the patient experience. Although activists continue to raise concerns about privacy and security, this is not likely to significantly inhibit the use of portals. Barriers include lack of reimbursement for their use, difficulties in patient authentications and, in some areas, lack of access to computer systems.

User Advice: Patient portals can be extensions of EHR systems or stand-alone systems. HDOs that have multiple EHRs or whose EHR does not have adequate portal functionality should consider using distinct portal platforms to construct Web-based composite applications. They are linking them to clinical applications (using service-oriented architecture [SOA] techniques — APIs and Web services — to reuse application and system logic and data). However, expectations need to be set. Appropriately interfaced portals require clinicians to step outside of their regular workflows and use a "different" system, and clinical data may not be available for automated clinical decision support or care management functionality.

Portals that are tethered to an EHR have the advantage that the patient-clinician interactions are part of the normal EHR workflow, but only have access to the clinical record contained within the system.

HDOs should, at the very least, have a short-term plan for adding a clinical patient portal to provide access to test results. More importantly, they should have a longer-term plan to extend interactive capabilities, including patient-provider communication and e-visits. Although vertical platforms or portal platforms can be useful, especially if the organization has multiple clinical applications, the functionality of a portal provided by the enterprise EHR system tends to fit clinician workflow better and is, therefore, better used. The patient portal strategy should also be aligned with a self-service kiosk strategy.

Business Impact: Initially, clinical patient portals primarily provide patient access to results, and can increase patient satisfaction and improve brand loyalty. As more-robust interactive functionality is built in, HDOs can expect improvements in clinician productivity. In addition, organizations can improve the quality of care delivered by using the clinical patient portal to improve communication between patients and providers.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Alere (Wellogic); Allscripts; Carefx; Cerner; Epic; InterSystems; Kryptiq; Medicity; Medseek; Orion Health; RelayHealth; Siemens

Recommended Reading: "Six Ways HDOs Can Improve the Patient Experience"

"Top Actions for Healthcare Delivery Organization CIOs: Use IT to Better Engage and Influence Patients"

"Case Study: Henry Ford Health System's Enterprise Portal"

Enterprise Content Management

Analysis By: Barry Runyon

Definition: Enterprise content management (ECM) is used to create, store, distribute, discover, archive and manage unstructured content (such as scanned documents, email, reports, medical images and office documents), and ultimately analyze usage to enable organizations to deliver relevant content to users where and when they need it. ECM is increasingly used by HDOs to create a centrally managed repository of electronic documents, bridging the gap between the administrative, business and clinical systems used to store structured healthcare information.

Position and Adoption Speed Justification: Healthcare delivery organizations (HDOs) often have many departmental document management systems related to their various administrative, business and clinical workflows. ECM is used by HDOs to create a centrally managed, comprehensive repository of electronic documents, bridging the gap between the various clinical and administrative applications and the systems used to store structured (typically housed in a database) healthcare information. ECM can help HDOs take control of their content, and, in so doing, boost productivity, encourage collaboration and make information easier to share. Some ECM vendors have technology components, such as digital asset management (DAM), for handling rich media, electronic forms and document composition for the high-volume generation of customized documents.

As e-discovery requirements in HDOs continue to grow, the value of having a trusted system of record also increases. By controlling access to content, managing the versions of content, and simultaneously reducing the reliance on less managed environments (such as email and file shares), enterprises can improve their overall data quality, and facilitate the leverage and reuse of high-quality information. HDOs are beginning to consolidate the host of departmental document management systems that they have had in place for some time in favor of enterprisewide platforms. Although document management is well-established with HDOs, an enterprisewide view or approach is relatively new, driven largely by the need to organize patient-related unstructured data for electronic health record (EHR) systems.

In January of this year, Lexmark International, the parent company of ECM vendor Perceptive Software, announced the acquisition of vendor-neutral archive vendor Acuo Technologies. This deal marks the beginning of the ECM era for healthcare providers. The acquisition of Acuo Technologies by Lexmark International will expand the HDO CIO's view of ECM and what it entails, and will begin to accelerate the HDO's movement from document management to ECM.

The maturity level of ECM has been pulled back from last year to better reflect the adoption level among HDOs worldwide.

User Advice: HDOs should take inventory of their various document and content management systems. Those that have unstructured content stored on file servers and in niche departmental document management and imaging (DMI) applications have an opportunity to identify and manage this content at an enterprise level and more easily integrate it with their mission-critical workflows. HDOs should consolidate content repositories where it makes sense, and develop exit strategies for legacy document management or content applications that are not considered critical, or that may

be addressed by a suite vendor. Resist installing stand-alone ECM components such as document management and imaging, Web content management and digital asset management applications. HDOs should view ECM as an enterprisewide information infrastructure that will support multiple business and clinical applications and workflows. Unstructured data is increasingly organized around the patient. HDOs should take steps to integrate aspects of ECM and business intelligence (BI) systems for the purpose of clinical decision support and mining value from unstructured data.

Business Impact: HDOs are just beginning to consolidate the host of departmental document management systems that they have had in place for some time in favor of ECM. Although document management is well-established within HDOs, an enterprisewide view or approach is relatively new, driven largely by the need to organize patient-related unstructured data for EHR systems. ECM systems are being integrated with EHR systems to link to unstructured clinical and business data, and in concert with enterprise image archives to manage and house non-Digital Imaging and Communications in Medicine (DICOM) objects. Recently, at least one major ECM vendor with a healthcare provider vertical has begun to build out its system to accommodate DICOM objects as part of a plan to serve as an enterprise vendor-neutral (image) archive. Many HDOs look to ECM technologies to make their business processes more efficient and to reduce costs. HDOs can automate vertical business processes, such as claims, billing and discharge processing, as well as to satisfy data requirements surrounding regulatory compliance, e-discovery, intranet, extranet, and website or portal publishing.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: EMC (Documentum); Hyland Software (OnBase); IBM (FileNet); McKesson; MedPlus; Microsoft; OpenText; Perceptive Software; Siemens

Recommended Reading: "Move From Document Management to Enterprise Content Management"

"Lexmark's Acquisition of Acuo Technologies Heralds a New ECM Focus for HDOs"

"Cool Vendors in Healthcare Providers, 2013"

"Maturity Model for Enterprise Content Management"

User Administration/Provisioning

Analysis By: Barry Runyon

Definition: User administration/provisioning solutions manage identities and their attributes across systems, applications and resources. They are used to create, modify, disable and delete user accounts and associated profiles to automate onboarding, offboarding and other administrative workforce processes. User fulfillment activity is initiated via self-service, management request or HR system events.

Position and Adoption Speed Justification: User administration/provisioning is often a partially automated workflow within most healthcare delivery organizations (HDOs). Manual intervention is almost always required, and HDOs rely on their IT personnel and departmental administrators to provision many of their systems and IT resources. These provisioning workflows involve a sequence of phone calls, interoffice communications, emails, spreadsheets and approval forms, and they are not often well-integrated or closely monitored, resulting in delays, productivity issues and unnecessary security risks to the enterprise. Gartner refers to any user administration/provisioning workflow that requires manual intervention for completion as "bridged." Fully automated provisioning is usually limited to a small set (20%) of mission-critical systems. The bridged approach is no longer tenable, given the number of clinical, business, and enterprise applications, systems, and resources that require routine and timely provisioning and deprovisioning. The problem is further compounded by the number and variety of potential users, locations and devices that are inside and outside the enterprise. User administration/provisioning can automate the process of deprovisioning user access to HDO IT resources and systems. This is an important access management guideline under the Health Insurance Portability and Accountability Act (HIPAA).

The advance of clinical automation, outreach to affiliated physicians and health information exchange initiatives, and increased compliance pressures will continue to drive the slow, but steady, installation of user administration/provisioning systems in the HDO. User administration/ provisioning deployments are complex, long-term projects that require considerable upfront planning and preparation (for example, role definitions), close coordination between IT and other departments (for example, HR), and often a significant amount of vendor services. As a result, user administration/provisioning projects have a lengthy time to value. A continuously weak economy worldwide has caused many user administration/provisioning projects to be canceled or deferred. As the planning and implementation of accountable care organizations proceed, and the need to manage care across multiple venues becomes more important, it will become increasingly important to coordinate user identities and access across organizational boundaries.

The adoption level of user administration/provisioning has not been modified from last year. This does not reflect on its inherent value to the enterprise; rather, it suggests that the value proposition is not yet clear, and that the complexity and cost of implementation remain high and do not compete effectively with compliance and security solutions that offer a shorter time to value.

User Advice: With increased clinical automation and interoperability requirements that extend beyond the enterprise firewall (for example, health information exchanges), the need for the consolidated, efficient and accurate provisioning of user identities and privileges has never been so compelling. User administration/provisioning should be implemented as part of an overall HDO identity administration strategy. If possible, user administration/provisioning should be implemented before other identity and access management initiatives, such as single sign-on and strong authentication measures. User administration/provisioning implementations are as much about planning, people, policies and processes as they are about the underlying technologies. Most failed or stalled user administration/provisioning implementations are a result of underestimating the effort required in these areas.

Avoid technology selection at the outset of planning, because it is best to have a decision framework that identifies, prioritizes and organizes resources for the initiative. Top-down planning that takes into account corporate security policies and operational processes improves the chances of user administration/provisioning deployment success. It is important to note, however, that user administration/provisioning won't deliver complete automation across all platforms and systems because of connector/adapter issues with certain custom and vendor applications. There is also a point of diminishing returns for the effort of automating complex administrative processes, which may be more efficiently handled with manual intervention.

Business Impact: Within the HDO, user administration/provisioning is the key to the timely decommissioning of departing employees; it also addresses the security and privacy provisions of the Health Information Technology for Economic and Clinical Health (HITECH) Act, as well as comparable regulatory initiatives in other countries. In addition, user administration/provisioning tools can automatically correlate data from HR, CRM, email systems and other "identity stores." Through the correlation of credentials from the various identity stores (directory services, application databases, email systems and so on) found in the enterprise, user administration/provisioning reduces the cost and complexity of administering and provisioning users. It becomes the authoritative repository of all user credentials and entitlements in the enterprise. User administration/provisioning can offer a significant return on investment over manual methods when it is properly aligned with an enterprise's workflow and approval requirements. Organizations seldom report a return to manual processes once the user administration/provisioning processes are effectively automated.

User administration/provisioning continues to mature and make identity-focused security operations more efficient; in addition, it enables easier compliance with regulatory and legal reporting and auditing. The implementation of an enterprise user administration/provisioning system typically requires significant work from a professional services firm. A large percentage of users that have to be provisioned within an HDO are not employees (for example, affiliated physicians, medical residents, visiting nurses, contract pharmacists, vendors and so on). The diversity of applications found in an HDO and the need for deep provisioning (access, privileges, preferences, roles and application functionality) make user administration/provisioning attractive.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Caradigm; CA Technologies; Courion; Evidian; Fischer International; Hitachi ID Systems; IBM; Microsoft; Oracle

Recommended Reading: "Magic Quadrant for User Administration/Provisioning"

Strong Authentication for Enterprise Access

Analysis By: Barry Runyon

Definition: Strong authentication is authentication based on at least two factors/credentials of different types. Only by using a factor of a different type, with a different set of vulnerabilities, will there be a significant resistance to attack. A common example is the combination of a password or PIN (knowledge) and a token (ownership). Strong authentication for enterprise access refers to the various multifactor credential requirements that are used to access IT resources inside and outside the corporate firewall.

Position and Adoption Speed Justification: The authentication marketplace encompasses a bewildering variety of authentication methods, each differing from the next in authentication strength, total cost of ownership (TCO) and user experience. Accuracy, scalability, cost and workflow integration have yet to meet the expectations of most healthcare delivery organizations (HDOs), and remain key inhibitors. Although some products have strength in one or two of these areas, no single product offers strong functionality across the entire spectrum. As these issues are addressed — most notably cost and ease of integration — strong authentication will be used to augment single sign-on (SSO) deployments in which high accountability is required. SSO can improve the user experience by reducing the number of credentials required to gain access to critical systems, and by replacing those credentials with strong authentication measures where and when appropriate.

Gartner has seen an increase in the number of inquiries from HDOs whose clinicians require secure, remote access to centralized administrative and clinical systems. They require a strong authentication approach that is convenient, affordable and maintainable, while offering an authentication strength (a measure of the method's resistance to attacks) that is commensurate with reasonably anticipated threats. These requirements will become more common as HDOs work to engage and retain physicians, and as they extend the reach of their critical clinical systems beyond the enterprise firewall. The use of a second-factor authentication token has been a way to meet this need. However, HDOs would prefer to avoid the inconvenience, cost and logistics of distributing and maintaining tokens, while adequately protecting high-risk transactions involving protected health information (PHI).

Many HDOs do not own, manage or have direct control over the workstations being used for remote access, and they cannot rely on the presence of a standard OS environment. Strong authentication measures, such as agentless PC inspection software (also referred to as client device identification [CDI]), challenge-response approaches (such as those used by the banking industry), mobile-activated one-time passwords and voice biometric approaches are alternatives. Each of these approaches has its strengths and shortcomings, and all are best-suited for trusted user communities.

U.S. Drug Enforcement Administration (DEA) regulations require multifactor authentication for physicians who electronically prescribe controlled substances, and on the system administration functions that control role-based access for those physicians. Although these requirements have not been implemented by all HDOs to date, they will drive the adoption of these technologies over the next few years. Because of the difficulty of managing multiple credentials, privacy and compliance concerns, and the need to expedite access to critical enterprise applications and systems, strong authentication measures have been increasingly adopted by HDOs.

User Advice: Use strong authentication measures in clinical and business venues within the HDO to secure PHI. Choose a combination of approaches that strengthens security, but does not impede workflow. Use in conjunction with SSO to address ease of use, scalability and integration issues. Strong authentication is most often adopted in support of a secure clinical workflow, and as a deterrent to medical identity fraud and abuse.

Consider strong authentication measures where high accountability and compliance are required. This includes common nursing and physician workstation access to clinical systems, as well as front- and back-office administrative access to admissions, medical records and financial systems. In these cases, strong authentication measures would likely include biometrics, proximity devices and smart cards. Passive proximity, using RFID, coupled with seamless roaming, can improve security and expedite access. Choose the best authentication method for each distinct use case by evaluating the trade-offs among assurance and accountability, TCO, and user experience.

More hospital employees and clinicians (owned and affiliated) remotely access hospital IT systems each year. This venue shift demands strong authentication measures to protect the PHI housed by an HDO. HDOs should plan to have strong authentication for remote access in place for use cases that involve remote access to PHI. They also should simplify access by avoiding the use of tokens, and should look for vendor products that use out-of-band authentication to preclude man-in-the-middle and man-in-the-browser attacks. If biometric authentication is a firm requirement, then HDOs should consider typing rhythm (behavioral analysis) or voice as a second factor.

A good authentication choice need not be the strongest available method — it must be strong enough — but enterprises have to balance this against user acceptance, cost and other considerations. Choose authentication methods that integrate with users' work processes and styles, rather than intrude or distract, while meeting reasonable risk requirements and cost constraints.

Business Impact: Strong authentication inside and outside the enterprise is most often adopted in support of a secure clinical workflow, and as a deterrent to medical identity fraud and abuse. Certain strong authentication measures, such as biometric and proximity devices, can expedite access to the clinical workstation and provide for more seamless access to the clinical workflows. Careful attention must be paid to how these devices are supported by the clinical software, the SSO application and session timeout parameters to ensure that they all work together effectively to secure and streamline access. It is difficult to associate a hard ROI with this entry, unless we factor in the avoidance of the potential financial or reputational damage of a security breach.

Benefit Rating: Low

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Sample Vendors: ActivIdentity; AdmitOne Security; AuthenTec; Covisint; EMC (RSA); Entrust; Equifax (Anakam); Fujitsu; Imprivata; Indigo Indentityware; Microsoft; PassFaces; Precise Biometrics; ValidSoft; Verisign; VoiceVault

Recommended Reading: "Good Authentication Choices for Healthcare Delivery Organizations"

"Who's Who and What's What in the Enterprise Fraud and Misuse Management Market"

"Good Authentication Choices: Evaluating X.509 Smart Tokens and Common Access Cards"

"Market Trends: The Impact of Mobile Computing on User Authentication"

"As HIPAA Regulations Get Teeth, Healthcare Firms Feel the Bite"

Entering the Plateau

Medical Device Connectivity

Analysis By: Wes Rishel

Definition: Medical device connectivity systems (MDCSs) are gateways between instruments or monitors and an electronic health record (EHR) system. They transfer and translate data between proprietary instrument formats and the input requirements of specific EHR products and versions. They typically provide buffering during EHR downtime and may flag data artifacts and provide the UI for a clinician to electronically review and sign the data.

Position and Adoption Speed Justification: MDCSs are a well-established technology that helps substantially with nursing efficiency and job satisfaction, and improves the timeliness and accuracy of charted information. They support high-acuity devices, such as infusion pumps and bedside monitors and portable devices carried by clinicians for use in lower-acuity settings, such as for capturing vital signs or oxygen saturation in medicine/surgery units or clinics.

A substantial value that is added by MDCS vendors is extensive certification of specific instrument software releases with their systems. Interfaces are available for many classes of devices, including patient monitoring, infusion, respiratory care, anesthesia administration, critical care monitoring and lab analytics. These libraries continue to grow year over year.

Some vendors have already achieved substantial penetration of the global market through direct channels and remarketing by EHR vendors. Most major EHR vendors have current experience working with these products in various workflows. Device manufacturers are increasingly supportive, because they realize that EHR integration affects the time to market for new instruments.

In the U.S., many MDCSs are regulated by the U.S. Food and Drug Administration (FDA) as medical device data systems (MDDSs). Under this rubric, manufacturers do not require premarket approval, but must meet requirements for good manufacturing practices, including formally tracking problems and resolutions, collecting adverse events and giving the FDA an annual report of adverse events. These regulations apply to healthcare development organizations that have built their own MDCS software.

FDA requirements are not specified for higher-functioning products that modify the data or the display of the data or, by themselves, control the functions or parameters of any other medical device or are used in connection with active patient monitoring. A device that otherwise would be

an MDDS is involved in active patient monitoring if the data it transfers is used for continuous monitoring of a patient or for immediate clinical decision making. If an MDCS performs these additional functions, it is regulated more strictly, although the U.S. FDA approach is case by case.

We have positioned this technology toward the end of the Hype Cycle, because the usage of these products is steady and uncontroversial, as evidenced by a low level of inquiries in 2011 and 2012.

User Advice: HDOs that have EHR systems should use this technology. They should also:

- Obtain business sponsorship from nursing and critical care medicine for an MDCS project.
- Determine business value and success by using metrics regarding the time until device data is available in the EHR system, and the use of nursing time, and be sure to do a baseline study.

HDOs should evaluate self-developed interface software for whether it meets the definition of an MDDS. If so, they should adopt good manufacturing practices and institute adverse event reporting, and file that data with the FDA. If they have self-developed software that exceeds the definition of an MDDS, they should seek the advice of counsel or consultants familiar with FDA procedures to decide whether to file a 510(k) premarket notification.

Business Impact: Medical device connectivity:

- Allows the clinician to spend more time on direct patient care, providing demonstrable savings in nursing full-time-equivalent (FTE) requirements.
- Improves the accuracy of charted vital signs and other respiratory and blood parameters.
- Enables near-real-time access to this data and EHR-improved decision making and automated alerts.
- Provides a faster time to market for new instruments and more-consistent instrument interactions with EHR systems. Introducing device integration into nursing workflows ensures more-productive use of nursing time, more-accurate charting and more-timely use of decision support.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

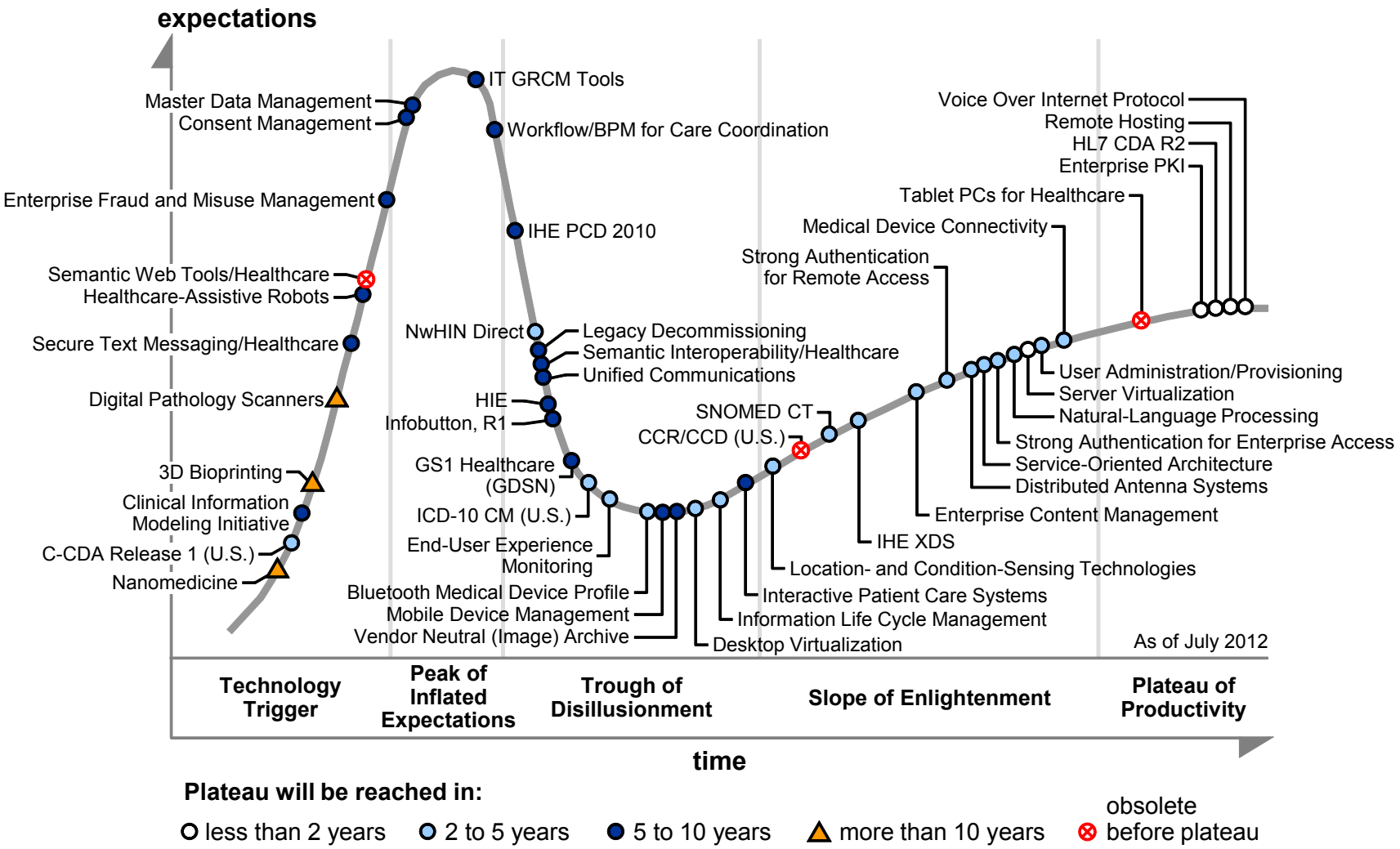
Maturity: Early mainstream

Sample Vendors: Bridge-Tech Medical; careTrends; Capsule Technologies; Cardiopulmonary Corp.; Cerner; Dawning Technologies; GE Healthcare; iSirona; Nuvon; Sensitron; Siemens Healthcare

Recommended Reading: "The Evolving Market for Universal Medical Device Buses"

Appendixes

Figure 3. Hype Cycle for Healthcare Provider Technologies and Standards, 2012



Source: Gartner (July 2012)

Hype Cycle Phases, Benefit Ratings and Maturity Levels

Table 1. Hype Cycle Phases

Phase	Definition
Innovation Trigger	A breakthrough, public demonstration, product launch or other event generates significant press and industry interest.
Peak of Inflated Expectations	During this phase of overenthusiasm and unrealistic projections, a flurry of well-publicized activity by technology leaders results in some successes, but more failures, as the technology is pushed to its limits. The only enterprises making money are conference organizers and magazine publishers.
Trough of Disillusionment	Because the technology does not live up to its overinflated expectations, it rapidly becomes unfashionable. Media interest wanes, except for a few cautionary tales.
Slope of Enlightenment	Focused experimentation and solid hard work by an increasingly diverse range of organizations lead to a true understanding of the technology's applicability, risks and benefits. Commercial off-the-shelf methodologies and tools ease the development process.
Plateau of Productivity	The real-world benefits of the technology are demonstrated and accepted. Tools and methodologies are increasingly stable as they enter their second and third generations. Growing numbers of organizations feel comfortable with the reduced level of risk; the rapid growth phase of adoption begins. Approximately 20% of the technology's target audience has adopted or is adopting the technology as it enters this phase.
Years to Mainstream Adoption	The time required for the technology to reach the Plateau of Productivity.

Source: Gartner (July 2013)

Table 2. Benefit Ratings

Benefit Rating	Definition
Transformational	Enables new ways of doing business across industries that will result in major shifts in industry dynamics
High	Enables new ways of performing horizontal or vertical processes that will result in significantly increased revenue or cost savings for an enterprise
Moderate	Provides incremental improvements to established processes that will result in increased revenue or cost savings for an enterprise
Low	Slightly improves processes (for example, improved user experience) that will be difficult to translate into increased revenue or cost savings

Source: Gartner (July 2013)

Table 3. Maturity Levels

Maturity Level	Status	Products/Vendors
Embryonic	▪ In labs	▪ None
Emerging	▪ Commercialization by vendors ▪ Pilots and deployments by industry leaders	▪ First generation ▪ High price ▪ Much customization
Adolescent	▪ Maturing technology capabilities and process understanding ▪ Uptake beyond early adopters	▪ Second generation ▪ Less customization
Early mainstream	▪ Proven technology ▪ Vendors, technology and adoption rapidly evolving	▪ Third generation ▪ More out of box ▪ Methodologies
Mature mainstream	▪ Robust technology ▪ Not much evolution in vendors or technology	▪ Several dominant vendors
Legacy	▪ Not appropriate for new developments ▪ Cost of migration constrains replacement	▪ Maintenance revenue focus
Obsolete	▪ Rarely used	▪ Used/resale market only

Source: Gartner (July 2013)

Recommended Reading

Some documents may not be available as part of your current Gartner subscription.

"Agenda Overview for Healthcare, 2013"

"Cool Vendors in Healthcare Providers, 2013"

"Predicts 2013: For Healthcare Delivery Organization IT Leaders, Great Potential Will Produce Greater Responsibility"

"Understanding Gartner's Hype Cycles"

More on This Topic

This is part of an in-depth collection of research. See the collection:

- Gartner's Hype Cycle Special Report for 2013

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