



# **EHRVA Interoperability Roadmap**

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**Version 2.0**

***Draft for Stakeholder Review***

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This is the 2006 release (V2.0) of the EHR Vendor Association Interoperability Roadmap. EHRVA members unanimously approved the release of this draft for stakeholder review on February 11<sup>th</sup> 2006. EHRVA encourages all stakeholders in regional and national health information networks to provide feedback on this Interoperability Roadmap.

5 ***Executive Summary:***  
**What the EHRVA Interoperability Roadmap Can Deliver**

10 The EHRVA Interoperability Roadmap supports the national goal of interoperable electronic health records and provides a pragmatic, logical plan that will succeed when adopted and implemented by key stakeholders. Based on proven methods and existing technology, the Roadmap considers a value-based approach that provides immediate benefits and outlines concrete steps to a future state in which the exchange of healthcare information across all care settings is supported in patient-centric manner. We provide this Roadmap to mobilize the leadership of healthcare organizations, information technology vendors and other relevant stakeholders to collectively deliver on the vision by incorporating this Roadmap into their plans.

15 The Roadmap includes the following key elements, benefits and methods to deliver an interoperable electronic health record:

**1. Collaborative process and collective agreement**

20 While the EHRVA does not govern vendors, there are acknowledged reasons to follow a common Roadmap. Interoperability only succeeds to the extent that many stakeholders implement a common technical framework. If organizations follow conflicting Roadmaps, they perpetuate the current condition of suboptimal interoperability and increasing implementation costs and timeframes.

To support broad adoption of the Roadmap, its elements have been developed in conjunction with the following:

- 25
- Use and consultation of standards development organizations (SDOs) at both the national and international level
  - International standards adoption organizations with the development of integration profiles
  - Support of several national health information technology (HIT) program organizations
  - Professional societies representing clinicians spanning diverse clinical specialties

30 EHRVA members involved in the U.S. and internationally agree that most of the interoperability components needed for national HIT programs in clinical information are common to a high degree. Relatively few areas require specific national customization. If such variations are identified within the internationally agreed Standards and Integration Profiles, they can be handled as national extensions and be much more easily implemented.

**2. Articulating the desired outcome and value to the healthcare system**

35 The vision of an electronic health record (EHR) will be realized when pervasive adoption of HIT is achieved. Only when the caregivers' processes are demonstrably improved and quality and cost benefits realized will private investment be made in technology. The Roadmap considers this and defines the value needed to facilitate adoption of technology. This value, along with the direction given by the American Health Information Community (AHIC), drives the logical sequence of components defined  
40 within the Roadmap.

### 3. Definition of the Core Technical Framework and approach to interoperability

The Roadmap delivers key elements and requirements of the proposed national health information network (NHIN) or any health information exchange (HIE). These include the following:

- explanation of use-case levels and focus;
- support for all edge HIT systems which will connect to the network;
- support for the variety of architectures deployed and methods to integrate them to the network;
- definition of the components needed to create the network;
- and pragmatic planning and incremental approach to provide immediate benefits on which to build additional capabilities.

### 4. Identification of the Fundamental Requirements and Infrastructure

The phased approach of the Roadmap defines and delivers required infrastructure to facilitate cross-enterprise and constituent communication:

- Security and access control;
- Patient/provider identity management;
- Persistent Information management (storing/sharing aggregated records from uncoordinated sources across time, e.g., medical summaries);
- Dynamic information access (direct request/response interactions to specific target systems, e.g., query of immunization registry);
- Workflow and quality (cooperative work distributed across entities, e.g., ordering and results of lab tests or prescriptions).

### 5. Implementation Plan and Timeframe

The EHRVA Interoperability Roadmap is based on four specific architectural and process assumptions for implementing a national health information network:

- Healthcare applications are “edge” systems connected to a “thin” NHIN.
- The NHIN should be deployed by encouraging sub-networks managed by sub-network organizations (e.g. RHIOs). All sub-networks must use the same “common framework” of interoperability standards and policies to ensure reuse of products, experience, and easy flow of nation-wide health information.
- The NHIN should be deployed utilizing an approach that allows the incremental deployment of services to provide healthcare information exchange. We call these “communication services”.

EHRVA expects the Interoperability Roadmap to be delivered in four phases, each driven by use cases that explain why information exchange is necessary. These phases build on each other and provide increasingly rich functionality to deliver the electronic health record within President Bush’s requested timeframe

- **Phase 1: Share Care Status Information**  
Structured medical summaries to support transition of care among providers.
- **Phase 2: Share Diagnostic Results and Therapeutic Information**  
Adds patient-created information and emergency summaries plus e-Lab and e-Prescription.

- **Phase 3: Clinical Decision Support and Advanced Access Control**

80 Extends access control, exchange of continuity of care documents and dynamic queries for medications and allergies with extensively coded information.

- **Phase 4: Collaborative Care, Active Quality Reporting and Health Surveillance**

Introduce workflow-oriented collaborative services and the second generation of public health surveillance and quality reporting.

85 The Interoperability Roadmap specified in this document is based on proven methods and existing standardized interoperability technology. Phase 1 is fully specified and early implementations have been tested, proving interoperability among more than 20 different electronic health record (EHR) systems, ancillary IT systems, and IT infrastructure components. It was introduced into clinical use in 2005 and several regional and national projects around the world are planning deployment in 2006. Specification of  
90 Phase 2 integration profiles is under way with testing planned for 2007. Hundreds of person-years of work have been and continue to be invested by HIT vendors (i.e., not only EHR vendors), providers and other stakeholders world-wide to advance the interoperability solutions presented in this Roadmap.

## 6. Support for AHIC “Breakthrough” implementation

95 AHIC has published four key areas of focus for the industry as it relates to HIT. These “breakthrough” use cases are biosurveillance, chronic care, consumer empowerment, and EHRs. As these are refined, EHRVA expects that the Phase 1 and Phase 2 communication services of this Roadmap will offer many of the required interoperability elements.

## 7. Enabling the Transformation: Next steps

100 No single stakeholder can achieve implementation of interoperable electronic health records. Based on this fact, the EHRVA recommends the following:

1. Acknowledge and access the experience of industry stakeholders. An open dialogue that values the contribution of all stakeholders and intends to unite rather than isolate components of the system is critical to the long-term success of this initiative.

2. Utilize a pragmatic business case-oriented approach to planning. The journey is often as important as the destination in any transformation. Defining key milestones and incremental benefits on which to build success will ensure our work persists and builds the foundation for future developments..

3. Evaluate and harmonize national and private sector initiatives.

110 Honest consideration and efforts to understand proposals such as this Roadmap will further collective wisdom and build needed partnerships. Much thought, experience and dedication to the benefits of an interoperable healthcare system were employed in the development of this proposal. Understanding how this and other initiatives can work together will eliminate unnecessary distraction, duplicate work and conflict. And, in the end, we will achieve our common objectives sooner.

## 1. Scope and Assumptions

115 This Interoperability Roadmap represents the unified position of the HIMSS Electronic Health Record  
Vendors Association (EHRVA) and describes the incremental components and steps required to enable  
an NHIN. Included are architecture components, communications and data standards, and the process  
required to enable the secure exchange of healthcare information among source (or “edge”) applications.  
120 *“Edge” systems include electronic health records (EHRs) where data may be originated, stored and  
communicated to the core infrastructure components utilized to share that information among receiving  
applications that use it to support clinicians in delivering patient-centric healthcare.*

The EHRVA Interoperability Roadmap was initiated early in 2005 as part of the responses  
to the Office of the National Coordinator for Health Information Technology (ONC) request  
125 for information (RFI) to build a national health information network (NHIN, see side box<sup>ab</sup>).  
EHRVA members provide the collective expertise gained through years of  
implementation of technology in the majority of  
130 healthcare provider organizations in the US and in other countries. This real-world experience provides  
unique and important input to the process and serves as a conduit for healthcare providers’ perspectives  
as represented to EHRVA member firms by our customers.

On January 18, 2005, the EHRVA participated in two responses submitted to the Office of the National Coordinator for Health Information Technology (ONC):

- As one of the 13 members of the Connecting for Health (CFH) Collaborative (See Ref b)
- As the EHRVA, expanding on the above response. 2005 Roadmap elements (See Ref a)

The audiences for this document include:

- 135
- community, regional and national health network architects,
  - public and private sector standards development organizations (SDOs) which share responsibilities to determine national and international processes for healthcare interoperability requirements, and
  - legislators and policymakers who are driving policies, funding initiatives and regulations which will
- 140 impact the adoption of EHRs and other health information technologies that support the ONC Strategic Framework published in June 2004.

The elements of this Roadmap have been evaluated in test environments and refined throughout 2005. This updated version of the EHRVA Interoperability Roadmap is based on four specific architectural and process assumptions for implementing an NHIN:

- 145
- Healthcare applications are end-point systems connected via a “thin” NHIN.
  - The NHIN should be deployed by encouraging local sub-networks or HIEs, managed by sub-network organizations (SNOs) (e.g. RHIOs). All sub-networks must use the same “common framework” of interoperability standards and policies to ensure reuse of products, experience, and easy flow of nation-wide health information.
- 150
- The NHIN should be deployed utilizing an approach that allows the incremental deployment of services to provide healthcare information exchange. We call these “communication services”.

155 In this document, the use of the terms NHIN, RHIN, HIE, sub-network, RHIO, SNO is introduced in Appendix A.

A Roadmap definition is required to specify a first set of healthcare information exchange services. Over time, this evolving set of communication services will be implemented and tested using recognized best practices for the selection, profiling and integration of interoperability standards.

160 The EHRVA has evaluated different modes of information sharing and recommends initial focus on “digital document” sharing. This recommendation is based on the need to simplify access control, clarify responsibilities of the sources of information and support the modular definition of the content. This will be expanded, as proposed in later phases of this Interoperability Roadmap to support more advanced healthcare processes.

165 EHRVA expects the Interoperability Roadmap to be delivered in four phases:

### **Phase 1: Share Care Status Information**

170 EHRVA recommends achieving the first level of interoperability using digital document sharing based on the *Integrating the Healthcare Enterprise (IHE, see www.ihe.net)* process in the context of a new IHE Patient Care Coordination domain. This domain has been developed with significant clinician involvement for defining the core content of medical summaries.

175 EHRVA has closely monitored the development by IHE of its medical summary Integration Profile to ensure fair evaluation of both *ASTM Continuity of Care Record (CCR, see www.astm.org)* and *HL7 Clinical Document Architecture (CDA, see www.hl7.org)*. IHE chose for its first two medical summaries (specialist referral and discharge summary) to leverage HL7 CDA (along with the Care Record Summary, CRS, implementation guide). EHRVA considers this choice only a first step while waiting for completion of the joint effort by ASTM and HL7 to define a joint Continuity of Care Document, supporting CCR content with the supporting coded vocabularies in a CDA format, which is slated for Phase 3 of this Roadmap.

This phase also include the sharing of imaging reports and medical images.

### **180 Phase 2: Share Diagnostic Results and Therapeutic Information**

This mid-level phase focuses on broadening the clinical information exchanged:

- Introduce patient-created summaries and emergency referral summaries.
- Enable the EHR-to-EHR sharing of finalized laboratory reports
- Support the electronic prescription as well as the lab ordering/real-time results workflows

### **185 8. Phase 3: Clinical Decision Support and Advanced Access Control**

This phase focuses on the introduction of robust coding of clinical information to:

- Implement the outcome of the convergence of the ASTM CCR standard with the HL7 CDA, standard;
- Support dynamic access to selected sources for on-line medication and allergy lists;
- 190 • Provides increased flexibility to the consumer in managing access more fine grained permissions for access by providers to own health information.

### **9. Phase 4: Collaborative Care, Active Quality Reporting and Health Surveillance**

Such workflow extensions can now be deployed as the basic information exchange and main ancillary services access have been addressed. In particular:

- 195 • Public Health Outbreak alert notification and advanced quality reporting;
- Referrals to consulting physicians, order for durable medical equipment;
- Bed availability checking;
- Dynamic queries for problem lists.

200 The establishment of the American Health Information Community (AHIC) is a milestone resulting from the ONC Strategic Framework published in 2004. The initial NHIN RFI culminated in four contracts being awarded for standards harmonization, EHR certification, NHIN architecture pilots and evaluation, and improvement of security/privacy regulations. AHIC, through its oversight of these contracts, has begun to execute on ONC's strategic objectives as well as the collective recommendations received in response to the RFI.

205 EHRVA provides this Interoperability Roadmap to reflect incremental progress that is being made, actions taken and planned by the contractors, as well as a means to inform all participants.

In addition, the Roadmap reflects the demonstrated progress the EHRVA has made with other private and public healthcare stakeholders in the United States and worldwide in realizing our collective healthcare information exchange goals. Continuing that progress is a primary goal of the EHRVA and this Interoperability Roadmap outlines the steps required to further the pragmatic implementation of health information exchange.

## 2. Process for Creation of the EHRVA Interoperability Roadmap

215 The process to build a credible Roadmap requires experience, thoughtful planning and clearly-defined objectives. The EHRVA utilized the following core competencies to direct the development of this Roadmap:

- **Employ a process-driven approach to support the business case for health information exchange**

220 EHRVA believes that interoperability among health information systems used to support clinicians and patient care has the potential to transform healthcare. Achieving continuity of care among providers across a community or region involves communication between the patient and a variety of clinicians, potentially in different facilities and different locations. This emerging model of integrated care delivery requires the adoption of a collaborative care process, built upon technology and information systems to enable high quality, efficient healthcare delivery that results from the benefits that technology can provide.

225 Yet, healthcare lags behind other industries in its use of information technology and is faced with overcoming significant barriers that prevent widespread adoption. Many of these barriers pertain to interoperability, the lack of deployed effective standards and incompatibility among different information systems. However, even with such standards in place, adoption of technology is not a foregone conclusion. Initial and ongoing maintenance costs incurred to build a standardized infrastructure and deploy information systems can be high. Providing the business case to justify these costs, as well as the cost to upgrade existing systems, is challenging and the positive long-term return on investment difficult to measure.

230 In order to overcome these barriers, leadership must recognize the relationship between information technology and clinical process and workflow. The real benefit of interoperability, the transformation of healthcare, will only be achieved when the deployment of EHRs and healthcare IT is viewed as a process-enabler, not a technical project. This process should include agreed-upon target outcomes, which provide immediate value as they are accomplished. Combining each of these targets in an evolutionary plan provides a goal-oriented approach that provides incremental benefits to offset costs incurred on the path to the patient-centric healthcare system from which we all benefit.

240 While leadership is essential to any process improvement effort, engaging key stakeholders, especially clinicians, is also crucial to ensure successful change management. Understanding the workflow requirements of end-users, and how to improve upon them to solve business problems, is a key to

providing acceptable solutions. The need to rationalize health processes is also recognized by an increasing number of clinical professional societies and quality improvement initiatives.

245 Managing each unique person's health is a not discrete task. It is a complex process that involves multiple providers and organizations, various points of care, payers, and other entities s such as pharmaceutical companies, public health and other local state and federal government organizations, Achieving standardization and interoperability in such a complex environment is an ambitious undertaking. Success will only be accomplished by building on the experience of previous interoperability  
250 initiatives.

Providing value to the care process at reasonable costs will accelerate technology adoption and positive healthcare outcomes. Interoperability is not the end game, but a practical and evolutionary process that requires clear choices based on expediency, efficiency and methods that balance short-term and long-term goals.

255 • **Leverage worldwide recognized success**

Sharing health information electronically at regional or national levels is a worldwide topic and an important goal for many countries. While each country has unique requirements, those are largely common when it comes to the delivery of care and the need for health information technology to enable patient- centered care, improve quality and lower costs. These efforts should be recognized and the  
260 lessons learned from those efforts applied. These initiatives also provide the proof points that interoperability and health information exchange can indeed occur. An important example of such an organization and such proof statements is Integrating the Healthcare Enterprise (IHE).

IHE is recognized as a major interoperability initiative within the United States, Canada, Europe and Asia. The IHE process offers a proven tool for the implementation of established standards. It creates the technical framework for passing vital health information seamlessly—from application to application, system to system, and setting to setting - across multiple healthcare enterprises. In its seven-year history, IHE has been led by organizations representing clinical stakeholders, including the American College of  
265 Cardiology (ACC) and the Radiological Society of North America (RSNA). They engaged a broad range of information technology vendors recognizing that the IHE collaborative process results in progress toward common goals. IHE developed this unique process and culture for producing its framework for interoperability by:

- Combining the collaboration of the primary stakeholders in an efficient and focused manner;
- Operating on a yearly cycle to ensure rapid and immediately applicable steps;
- Providing practical testing tools and information resources that facilitate adoption of standards-  
275 based integration solutions, and
- Enabling both healthcare entities and vendors to improve access to information incrementally.

10. IHE employs a use-case based methodology, which is being advanced through the efforts to support standards harmonization, compliance certification, and NHIN prototype projects. This methodology supports the analysis of standard domains and identifies where overlaps and gaps exist and require  
280 reconciliation and/or definition.

• **Recognize and advocate for the standards appropriate to healthcare**

Providing quality healthcare is a complicated and high impact process. Stakes are high in each instance of clinical care, as the end result can ultimately be measured in terms of life or death. Few existing industries carry that complexity and burden in the development and implementation of standards.

285 Analyses of clinical care processes by a variety of standards development organizations — IETF<sup>c</sup>, OASIS<sup>d</sup>, W3C<sup>e</sup>, HL7<sup>f</sup>, ASTM<sup>g</sup>, DICOM<sup>h</sup>, SNOMED<sup>i</sup>, LOINC<sup>j</sup>, ICD<sup>k</sup>, IEEE<sup>l</sup>, ISO<sup>m</sup>, NCPDP<sup>n</sup>, ANSI X12<sup>o</sup>, etc., and several clinical professional organizations – require the combined use of these base standards

290 to reliably convey enough information to deliver adequate care. While potentially independent  
“standards” do not make the goal of harmonized standards unachievable, the process of using them in a  
plug and play manner and combining them is complicated. This is where international agreements on  
information relationships expressed in information models (e.g., HL7 Information Models) can be used to  
integrate standards efforts (Appendix A).

Stakeholders engaged in the discussion and development of interoperability standards are striving to  
achieve these goals:

- 295 • A single set of standards that enable rapid implementation of interoperable applications to  
exchange patient information required to deliver quality care
- A precise combination of these standards, (such as IHE’s Integration Profiles) that can be  
updated incrementally to minimize both rework and costs as applications evolve to meet changing  
functional and environmental requirements.

300 When standards are defined to complement each other in a systematic way, through the involvement of  
appropriate clinician and vendor input, they will provide maximize value to clinicians and minimize  
development and implementation costs to vendors and their customers.

This has been recognized by the Federal government with significant efforts from National Committee on  
Vital and Health Statistics (NCVHS) which has published several reports on standards and the Federal  
305 Health Architecture’s selection of key standards.

These efforts require refining the standards to a more useful and realistic starting point that can support  
incremental implementation. Integration profiles and implementation guides will also be required to  
support software developers and users in achieving extensible “plug-n-play” interoperability.

310 Increasingly, national leadership has recognized the need for a consistent standards-based technical  
framework to achieve interoperability. They have established organizations to engage with the health  
information technology industry to set this framework:

- The American Healthcare Information Community (AHIC) serves as a leader in identifying  
breakthrough opportunities, and
- 315 • The Healthcare Information Technology Standard Panel (HITSP) brings together all relevant  
stakeholders to identify appropriate IT standards and endorse integration profiles that meet  
selected use cases.

EHRVA supports the work of these organizations and applauds their efforts to set both strategic and  
tactical direction to enable the accelerated adoption of electronic health records. EHRVA will fully engage  
these organizations to share the pragmatic experience that vendors can provide to balance current and  
320 future technologies and end-user requirements to achieve a feasible Interoperability Roadmap. This  
Roadmap is intended to provide valuable guidance to AHIC, HITSP and similar organizations worldwide.

- **Define incremental milestones and objective criteria**

EHRVA supports an incremental approach to achieving interoperability to quickly provide valuable  
healthcare information exchange with the current generation of healthcare technology products, while  
325 ensuring that richer levels of interoperability are accommodated in the future. To that end, EHRVA has  
taken on the leadership role in defining a future state of interoperability and a Roadmap to get us there.  
Essential to this is the identification of short-term steps to provide incremental progress toward an  
interoperable healthcare system. Each step the EHRVA defines follows these objective criteria:

- Provide value
  - 330 ○ Patient care improvement
  - Financial viability

- Maximize previous investments
- Implement in logical order
- Provide foundation for additional levels of interoperability

335 As national initiatives and breakthrough areas emerge, EHRVA will reevaluate the Interoperability Roadmap and update it as necessary to meet new requirements and take advantage of new technologies. Work to deliver on the Roadmap is currently proceeding on track and is published here to add further definition as a result of progress achieved.

- **Engage with industry stakeholders to foster collaboration and enable widespread adoption**

340 Actual interoperability among HIT systems requires more than agreed-upon message and content standards. Applications are only as useful as they are used. Use can be driven by the value of the application itself to end-users, as well as by the costs and processes needed to maintain the technology.

345 To address the value provided to end-users, vendors and providers must collaborate to ensure that applications and their implementation processes are both valuable and sustainable. This is a collaborative process that requires the engagement of both vendors and end-users, particularly clinicians. Without representing both the technology solution and the clinical environment, the end result will fall short of the mark.

350 Providing applications, which are rich in functionality and valuable to end-users is not enough. The applications and standards employed must be flexible to minimize support costs as clinical and technical requirements evolve. Working closely with physicians and others involved in healthcare, the EHRVA is identifying specific use cases to define the necessary information, in a standard format to satisfy end-users and those who implement and maintain HIT. A comprehensive effort by all stakeholders is needed to drive adoption.

### 355 **3. Achieving the Value of Incremental Interoperability**

11. The definition of this Interoperability Roadmap proceeds from the need of information exchange as they are felt by the users of EHR systems. Appendix B demonstrates, starting from a real-world scenario proposed by the Commission on Systemic Interoperability, how the various communication services identified by this Roadmap result in the progressive transformation of the way healthcare is delivered.

360 Starting from the way Dr Africano use its EHR System today, it describes a first evolution of a doctors' practice realized two years from now followed by an even more profound transformation, five years into the future.

### 365 **4. Agreeing on Objectives and Realistic First Steps**

As the EHRVA shares its vision for the development and nationwide implementation of an interoperable health information technology infrastructure, it must also support the national goals of improving patient safety, enabling better coordination of care across care settings and reducing skyrocketing healthcare costs. A broad range of functionality will eventually be needed to adequately address these goals, but the critical first question to be answered is "Where to start?".

370 We must articulate incremental improvements from a realistic first step to a clearly defined end goal. Each step of the way must bring us closer to realizing the benefits of a NHIN. The Roadmap must communicate

375 the development of a network capable of bringing order to the developing cloud of information now being stored in non-homogeneous systems. Each step must be achievable in a desirable timeframe and cannot be considered "throw away", but must have long-term viability.

The steps toward secure and portable health information for American consumers should be built on the existing interoperability collaboration among all stakeholders, in particular users and vendors. In addition, we must keep these points in mind as we shape the Roadmap:

- Support for ONC goals and objectives
- 380 • Ability to interconnect disparate systems
- Empowerment of consumers as well as providers
- Efficiency of access to "off network" data
- Adherence to a single, standard-based framework

385 Existing AHIC "breakthrough" use cases include the ability to improve quality of care, reduce costs, empower the healthcare consumer and provide a foundation upon which better public health monitoring and trend analysis tools can be built.

390 To empower consumers, the first step must embrace technologies that allow consumers to begin to control their personal health record and to ensure that their clinical information is not held discretely in separate records by different provider organizations. To empower providers, they must have control over the movement of data from their private space to a shared space controlled by the patient. There must be assurance that they and other providers, will retain the ability to easily differentiate between provider-generated data and patient-generated data. In the loose environment of an NHIN, provider-generated data must be consumed as persisted by the source to establish trust in the integrity of the NHIN.

395 Particular care must be given to designs for retrieval of information stored outside of the patient's primary care provider's EHR system or integrated delivery network. Because of the limited time available in patient-provider encounters, technology, which adds more than a few seconds to the providers' workflow, is likely to be rejected by the marketplace. Providers must be presented, at least initially, with a minimal data set allowing for an informed decision regarding the relevance of information stored "off network" without requiring multiple queries to multiple edge systems.

400 A good example is the use of Internet search engines such as Google or Yahoo. Following a user's initial query, Google returns not only a list of relevant URLs, but also two or three lines of information (we call it meta-data) about each URL, which allows for human (or computer) optimized retrieval of the actual source documents. Just as Google would be ineffective if users had to connect with each site to determine for themselves the relevance of that site's data, the effectiveness of the NHIN will be  
405 compromised if the directory services provide only a path to servers, forcing providers to query all servers holding a patient's data before being able to make choices about the actual information available for retrieval. This requirement for efficiency is necessary both to provide reasonable response times and to minimize the number of "hits" delivered to each individual edge system. This search engine analogy is, however, not applicable to populating the registry which must be done by explicit request to each  
410 information source when it chooses to "publish" information, along with the corresponding few elements of meta-data that will populate the registry entry without revealing patient specific clinical information.

415 Accelerated adoption requires adherence to a single interoperable standard-based framework for the exchange of information. Rollouts using competing standards, such as Sony's Betamax vs VHS, HD DVD vs. BluRay, etc., demonstrate that adoption of new technologies can be significantly delayed if the industry cannot agree on a uniform set of standards in the context of use case-driven integration profiles specifications for their combined "plug-n-play" implementation.

In order to persuade vendors, providers and other stakeholders to make the necessary investments to implement the first step, it must be obvious to all that this first step has long-term viability. This is only possible when the first step is readily identified as being a modular component; a first incremental step towards a larger goal. Although all details of the larger goal need not be specified at this time, the general framework must be known to a sufficient degree to minimize obsolescence risks for the early adopters of the first step.

A predictable Roadmap, including a proposed timeframe for deployment, allows for strategic planning with other interoperability interdependencies, such as content standards, other domains of interoperability (i.e. financial), and for the inclusion of ambulatory and acute EHR certification requirements. The Roadmap must also identify the building blocks for phased implementation of interoperability components, allowing for ease of adoption for EHR Vendor Association clients as well as our own applications. In order to truly realize the revolutionary goals of a NHIN, the Roadmap must provide a thorough “big-picture” in order to avoid mis-steps such as the early ELINCS exclusion of hospital labs and the initial focus on ambulatory settings without appropriately factoring in the large role that emergency departments play in the delivery of ambulatory care.

The Roadmap, defining all known elements of the target, must be comprehensive. The first step must achieve meaningful progress, while focusing on objectives that are achievable within reasonable time frames. The first step must represent movement along the path towards the target, and must have a long life-cycle with minimal obsolescence risks. The first step should avoid areas in which standards have not yet been set, and/or areas for which the computational complexity is high (such as resolving differences between various instances of dynamic content, as represented within different domains).

## 5. Framework for interoperability

To begin a discussion on this framework, we must share a common understanding of the term “interoperability”. Interoperability is concerned not only with the ability to transfer data, but includes the ability for receiving applications to meaningfully process this data according to the meaning (information) intended by the sender. The level of richness of this “shared understanding” between communicating software applications, reveals a broad range of capabilities that are difficult to classify. This has resulted from more than 20 years of applications development that penetrates virtually all aspects of healthcare delivery, requiring healthcare stakeholders to agree on a definition of interoperability that is healthcare specific. Many definitions have been proposed (e.g. HIMSS, HL7, NAHIT, EHRVA, IEEE, CFH) and this framework does not need nor intend to choose a specific one to the extent that all proposed definitions are useful and valid. Nor is it necessary for the proposed Interoperability Roadmap to be read and understood. By the very nature of “interoperability”, it needs to be approached in a similar manner as “quality”. Quality must be approached specifically one “product” or “service” at a time, with explicit quality objectives. One must define for each “use case” or “communication service” the expected attributes of interoperability. Although not discussed at this level of detail, this work has been done in the course of the specification of base standards and integration profiles, as discussed in this section.

Interoperability requirements have two primary components: **technology and policy**. The technology component includes the data standards and integration profiles used to describe the structure, format and context of data being exchanged. The interoperability policy component provides the “rules of the road” as to what minimum types of data should be exchanged and the equal availability of that information to all entities that require exchange capability within the affected healthcare market.

While the EHRVA believes that the policy aspects of interoperability must be considered during the development of healthcare information exchange use cases, **the Interoperability Roadmap outlined in the following sections focuses on the technical aspects of interoperability**. The technical framework for health information exchange is relatively static as one moves from community to region and on to the national network. The policy framework will be shaped by the groups exchanging the

465 information and require input from those stakeholders. The technical framework must account for the  
requirements we can anticipate the policy to stipulate. While some information is currently present within  
exchange profiles (privacy, access, etc); the details of these agreements and relationships among those  
stakeholders will be defined outside of the technical framework.

The EHRVA distinguishes four levels at which a common framework for interoperability can be defined:

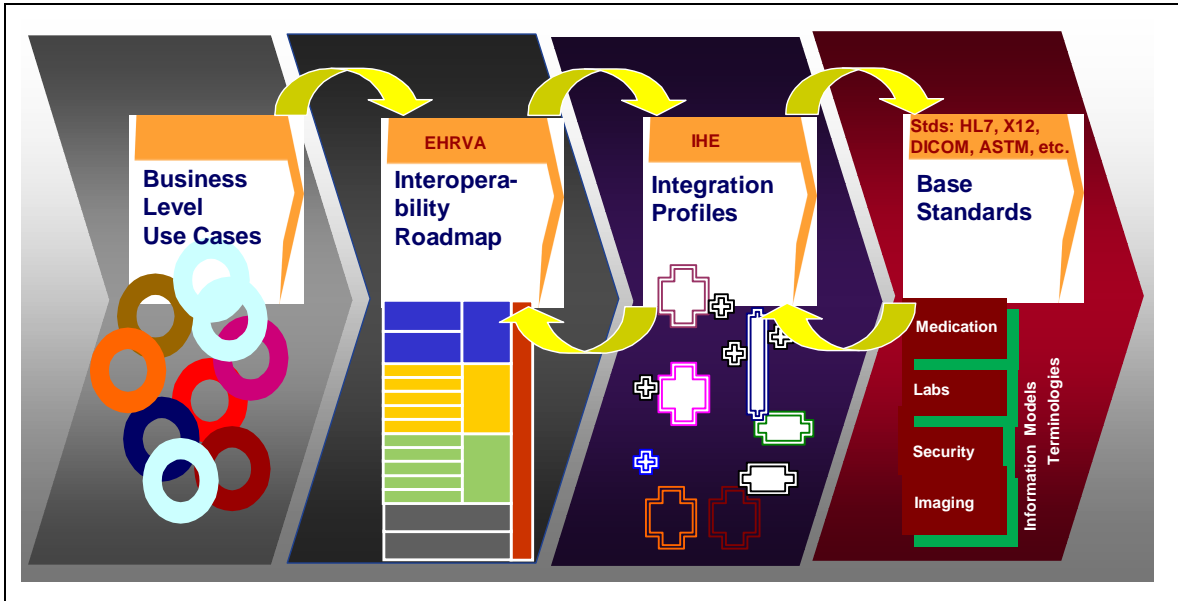
- 470 • **Business level** - This is the level at which AHIC defines its use cases. At this level, one can  
identify health system-level objectives such as “chronic disease management” or “patient  
empowerment with a medication history”. There are many ways of identifying and structuring use  
cases at the business level, which contributes to the challenge of creating a comprehensive list.  
475 A pragmatic approach employed by AHIC and ONC, as well as the vendor community, is to select  
three or four use cases to scope and implement. This provides a reasonable starting point to  
provide value while remaining achievable.
- **Communication Service Level** – A communication service defines a number of related means  
to exchange specific types of health information for the purpose of sending this information from  
one system to another or accessing it in a remote system. This level recognizes that a large  
480 range of use cases will be provided through business level requirements. One defines at this level  
core communication services that are most likely to be needed and tests their ability to support a  
broad range of likely business-level use cases. This is a use case-driven approach at an  
intermediate level, where the range of services is large but can be more easily organized and  
bounded. An example of this further refinement is in the terms used to communicate the services  
485 themselves: “electronic drug prescriptions”, “sharing of patient’s medical summaries”, “access to  
a patient’s current allergy list”. This is the level at which this Roadmap is positioned as a result of  
the cumulative experience and success the member companies of the EHRVA bring to the table.  
This use case- driven communication services level is well tested and continues to be utilized in  
projects throughout the world by EHRVA customers and members’ development projects.
- 490 • **Integration profile level** - This level is utilized by many applications in other industries, but has  
been championed for healthcare worldwide by IHE,. It is a level which is slightly more granular  
than the communication service level. It attempts to factor common interoperability building  
blocks in order to maximize reuse of specification and implementation methods, as well as  
allowing for evolutionary growth within a domain. Standards generally operate at a domain-  
495 focused level in that multiple standards are generally needed to define an integration profile. *The  
integration profile level is the level at which it is most practical to perform interoperability  
conformance testing.*
- **Base standard level** - This level received the contribution of a wide range of standards  
organizations. Some are non-specific to healthcare and provide the base standards that achieve  
500 basic IT interoperability or security management. Their use in healthcare, however, requires a  
number of tasks that are provided by the Integration profile definition level (i.e., selection among  
competing standards and choice of healthcare-suitable options when choices are offered). There  
is a wide range of standards development organizations and standards adoption consortia which  
provide valuable standards and guidance in this area. Some are specific to healthcare and  
505 provide the standards that achieve basic interoperability for healthcare information exchange.  
The multiplicity of standards organizations is no less daunting than those in the general  
healthcare technology space and is commensurate to the breadth and complexity of the various  
domains in healthcare itself.

510 Base standards development is also use case-driven but is faced with the significant challenge to  
anticipate the variety of needs and market evolution that the three levels above are addressing at  
various levels of granularity. In a sense, base standards are frameworks that enable the creation  
of messages and documents to support any possible use case in their domain. This flexibility  
makes standards development a long-term activity with often unpredictable delivery schedules.  
This is why EHRVA recognizes that standards development and integration profile development  
515 need to be two separate activities that operate on different schedules and consensus processes,  
but with strong two-way collaboration. Integration profiles shall only rely on approved standards,  
but standards development organizations should offer a reactive enablement of newly identified

520

content and a maintenance process for these approved standards as they make their way into integration profiles. While the controversial topic of overlap between base standards is a challenge for their combined use, gaps and inconsistencies are more often the issue.

This four level approach is illustrated in the figure below highlights how these four levels support each other by adding specific technical depth as one moves from the highest level of business use cases all the way to the very details needed to accomplish effective, testable and robust interoperability.



525

Business level use cases (left most hand-side) are many varied, and overlapping. Interoperability Standards (right most hand-side) are also varied and complex specifications. The middle two layers are where a critical rationalization and the definition of common solutions building blocks happen. This is where this document focuses.

530

The EHRVA Interoperability Roadmap applies to local, regional and national (and eventually trans-national) health information networks. It was established initially in January 2005. Its strategic direction has been further evaluated and confirmed with the present 2006 version. Four foundational elements are presented:

**1. Healthcare applications are end-point systems connected to a “thin” NHIN.**

535

- We must note the critical differences between an “application” and a set of communication services that enables information to be shared or exchanged between applications (such as EHRs). The NHIN, including any of its sub-networks, is not an application or a system. eRX is not in itself an application but a complex series of workflows that require interaction among people and end-point systems such as EHRs and retail pharmacy order fulfillment systems, supported by a set of communication services that allow information to be exchanged in a predictable, reliable and consistent manner among these and many other “edge” systems to support the workflow. The definition of use cases established by AHIC must recognize this distinction and ensure that the focus be on the needs of the clinical end-users and the information that needs to be exchanged.

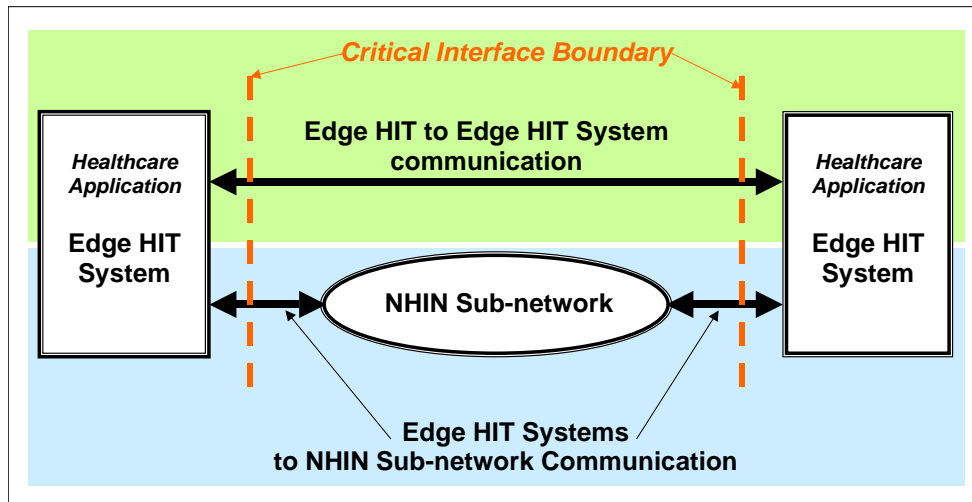
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545

- A “thin” NHIN refers to the notion that the Interoperability Roadmap should build upon the peer-to-peer model used in existing Internet technologies, which will allow the healthcare market to utilize and expand upon proven standards and technologies. This allows the healthcare industry to

build on current investments in web technology and focus on keeping maintenance costs low to enable technology adoption and sustain its use.

- 550 • The EHRVA Interoperability Roadmap distinguishes two levels of interfacing between end-point or “edge” systems:
  - The end-point system and the NHIN sub-network infrastructure, similar to the way a home PC interfaces over the internet using DSL+TCP/IP, and
  - 555 ○ peer end-point systems performing information exchange where the NHIN sub-network(s) is transparent to the applications running on these systems, similar to the way a home PC browser interfaces with a remote web server with no interference of the underlying internets/intranets.



560 This provides the ability to evolve the information exchange content at the end-to-end level, without requiring any evolution of the NHIN sub-networks. It is a critical element aimed at allowing a stable and cost-effective infrastructure of the NHIN sub-networks as increasingly richer and more specialized content is exchanged.

**2. The NHIN should be deployed utilizing an approach that allows the incremental deployment of services to provide healthcare information exchange.**

- 565 • The cost of implementing the NHIN cannot be ignored if it is to be successfully deployed. Much as a house re-design uses as much of the existing structure as possible to enable the new design, so must this implementation build on the technologies in which providers have invested to date. These investments must be taken into consideration if any Roadmap is to be successful in the public/private sector adoption efforts.
- 570 • The Roadmap must include the concept of extensibility. Establishing a base set of capabilities that can be expanded over time, allowing backward compatibility with older systems, while allowing newer capabilities to be introduced provides immediate value which builds over time. An example of this is available today with the ability to allow simple exchange of unstructured information (text), while planning to enable richer computer “consumable” structured, semantic information once standards for content and vocabularies are available.
- 575

**3. The NHIN should be deployed by encouraging the development of sub-networks, but all sub-networks must use the same “common framework” of interoperability technology standards and policies.**

- 580 • Utilizing a “common framework” of technology standards and policies will allow multiple sub-networks of the NHIN to be established in parallel to allow local or regional networks to begin

work as soon as practical while allowing the fabric of the NHIN to seamlessly weave together. This allows networks which are currently active to begin exchange with the national network as soon as they are ready and allows others to develop and come “on-line” as their timeframe dictates. A common framework eliminates unnecessary dependencies to provide the most benefit as soon as possible.

- Using the same technical framework for interfacing all end-point systems among multiple sub-networks provides economy of scale (i.e., reuse of software, as well as drastically reduced integration, training and maintenance costs) and allows healthcare providers, vendors and other users of healthcare information to focus their resources on providing healthcare delivery innovation in the foreground of the healthcare delivery process. This allows stakeholders to utilize their skill sets in the areas of most benefit – their core competencies.

**4. The EHRVA Interoperability Roadmap must allow for the incremental development and deployment of a first set of healthcare information exchange services beginning in 2006, using recognized best practices for interoperability standards selection, profiling and integration.**

- Immediate benefits are provided which create a foundation for further development via the segmentation of specific NHIN services to be implemented incrementally. This allows the flexibility needed within product development schedules, diffusion into the population and provider base and the interdependencies with other standard deployment efforts.
- The use of existing best practices jump-starts the process in the U.S. and globally. Implementation of standards-based interoperability, such as used by IHE allows the following:
  - Identification of critical workflows and use cases to provide immediate benefit.
  - Identification of requirements for the information and exchange protocol to support the specified workflows.
  - Prevalence and widespread adoption of these workflows which supports a “plug-n-play” environment. This ensures that EHRs and other end-point systems’ can be integrated predictably and at lower costs.
- The Interoperability Roadmap provides a demonstration of the possible NHIN infrastructure services well in advance of other projects through use of industry showcases that include a variety of stakeholders. The collaboration demonstrated by organizations such as IHE and its supporters is a concrete example of the spirit conveyed in the ONC request for proposal on the four key projects. The cooperation is not limited to tradeshow demonstrations but is visible daily as patients receive care in radiology and imaging centers across the world which share images using the Dicom standard. We maximize the value of the more public events to communicate the value of this work and drive support for the overall goal. These events serve as collaborative forums where industry stakeholders can dialogue with each other, the government and the public to showcase progress and engage the consumer.
- Finally, this provides a market driven focus of health information exchange. This exchange must serve a relevant purpose, one that provides a value to multiple stakeholders which is key to adoption of health information technology. A benefit of our market-driven approach is that we will solve real problems which must be solved in order to accelerate adoption of health information technology. If a use case does not provide enough value to expend effort and resources to implement, then the market will not adopt it. This has been proven via the experience of the EHRVA members, their customers and their patients.

**Enabling a Broad Range of Architectures**

The Interoperability Roadmap has been designed to support different architectures and configurations. Indeed, there are a number of factors (e.g. operational costs, scale of health information exchange, trust

630 policies, technology evolutions, disaster recovery, etc.) that will influence specific architectural deployment of these communication services. In particular, EHRVA recognizes that different approaches will co-exist in the design of NHIN sub-networks. However, maintaining the same set of communication services at the boundary between the edge HIT Systems and the NHIN sub-network will ensure that the majority of systems that need to be interfaced are minimally impacted by such architectural and configuration flexibility. Edge systems will number in the many thousands, whereas the NHIN sub-networks are expected to number in the hundreds or fewer.

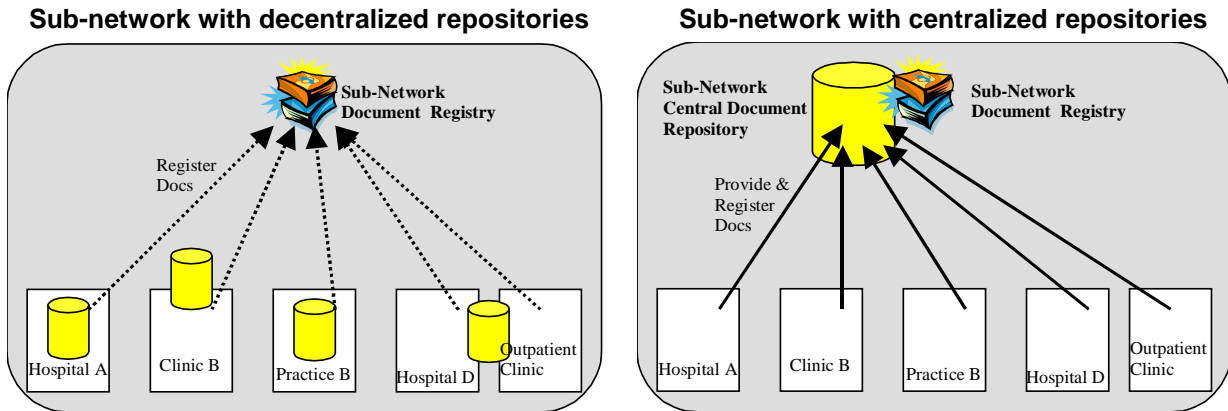
The communication services of this Roadmap have the following characteristics:

- 635 • Stored persisted information is supported in the following models:
  - o entirely decentralized (i.e. supported by the edge systems),
  - o entirely centralized model (e.g. central sub-network document repository)
  - o any mix of the above
- 640 • All applications are supported by edge HIT systems, including applications delivered through web access (i.e. applications shared by several users generally accessed through simple web browsers). All variants of application delivery (e.g. thick or thin clients) are supported as part of the edge HIT systems. Edge HIT systems may or may not use network infrastructures to interface their users. In terms of communication services, there is no difference between a web-based, remotely hosted doctors' EHR and an EHR system installed in a clinic. Edge HIT systems may range from small single doctor offices to large distributed IDNs. The inner structure of edge HIT systems is not constrained by the network but their communication with the health information network is explicitly defined.
- 645
- 650 • Record location services are part of the sub-network infrastructure. These will not contain patient clinical information, only minimal meta-information about the location of patient-related "records". This meta-information may be as minimal as:
  - o "Existence of information" in a location (i.e. edge HIT system or repository). This is what Connecting for Health has developed with their record locator service (RLS).
  - 655 o High-level information about a "dynamic communication service" where information for a patient may be accessed.
  - o "Generic attributes" of a shared document (e.g. a lab report or a medical summary published by a location at a specific time, but not the test results values) for a patient and the pointer where this document may be accessed. This is what IHE has developed with the Cross-Enterprise Document Sharing (XDS) Integration profile.
- 660 EHRVA believes that all three approaches are needed. By distinguishing record location services actors from repositories actors in defining integration profiles is critical to allow for both centralized and decentralized architectures.

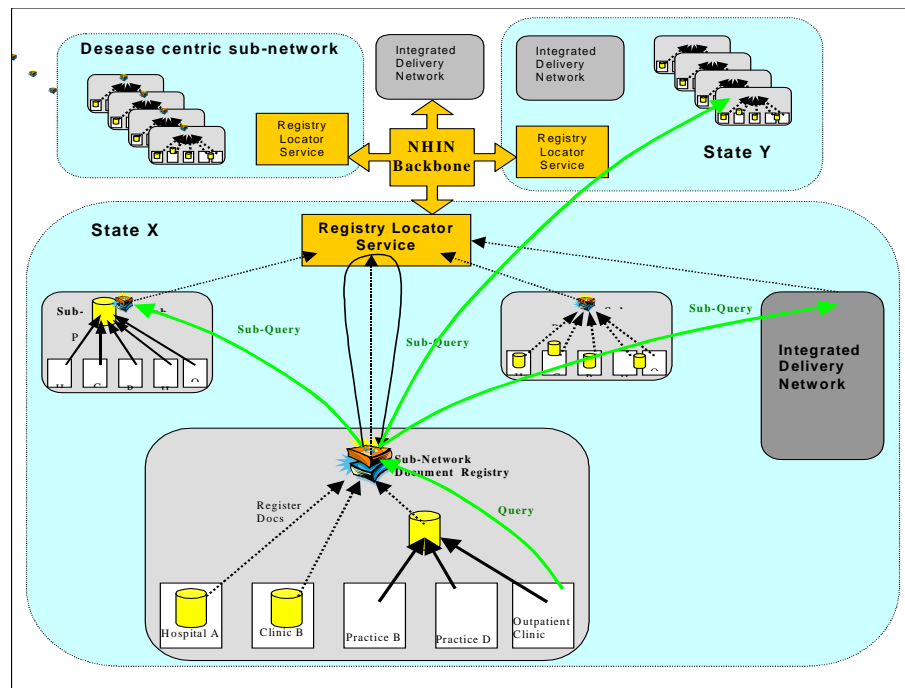
665 The above principles may make this Roadmap somewhat abstract for some non-technical readers. It is critical that these principles be applied to the definition of the communication services to ensure their greater flexibility in a variety of current and evolving deployment architectures. Three examples are provided below to depict three deployment models.

Example implementation architecture models:

670



Multiple sub-networks connected state-wide and to NHIN



675

### Ensuring privacy and building trust

The EHRVA wants to stress the need to design privacy protections into the NHIN and the Edge Systems it interconnects. The security infrastructure is not limited to the NHIN, or any of its sub-networks, but must encompass all systems including the edge systems. Any health information exchange is only as secure as its weakest system.

Securing healthcare data is extremely important, yet also more complex than general IT. In healthcare, there is an ordered list of assets to be protected. First and most important is the safety of the patient and caregivers; second is the privacy of the patient and caregivers. In healthcare there are emergency cases where privacy will take secondary priority to patient safety / harm. Most of the time both of these assets

can be protected simultaneously, but there are instances when protecting both assets will conflict. It is this factor that causes conflict when trying to secure healthcare information with technology alone. The solution needs to be a balance of policy / procedure with the technology available.

690 The information being protected has special security characteristics as well. In industries like banking, a consumer can be warned that their financial identifiers have been exposed and thus accounts can be closed; whereas healthcare data that gets exposed can't be changed or revoked. In healthcare, the ultimate solution for protecting patient information would be to provide case-by-case access controls to ensure the patient has complete power over whom and when their data is used.

695 The standards and technology to give this level of access control is likely to take 5-10 years to mature. Therefore, we need to carefully balance policy with available technologies to give the desired level of security. This interoperability Roadmap includes the following multi-year plan that protects privacy, provides accountability, and ensures patient safety.

- 700 • State of the art security technology includes access controls that prevent the unauthorized individuals from gaining access to any system storing or providing access to the patient health record (EMR or the NHIN or any of its sub-networks). The clinical users have unfettered access to ensure that the patient receives treatment, but this access is carefully tracked to provide accountability.
- 705 • In the next 1-3 years we expect to have access controls based on functional-role and broadly defined objects, with a shared understanding across organizational boundaries. This will ensure that those who have proper clinical credentials will have access to the types of information they need to best treat the patient. These controls will be at a coarse granularity, with the objects being controlled at the report, view, results, or study level; the role definition being controlled will be at a high level function. Critical to this level of control is standards-based user identity and permissions that can be uniformly enforced across the sub-network and its edge systems participating in a RHIO.
- 710 • In years 3-6, RHIO level access controls should take on the role of treating-clinician. This role is assigned to individuals that have a treatment relationship to the patient and thus should gain access to that patient's information. This is somewhat available in a single organization EHR system today; extending this to the sub-network and its edge systems will be a significant gain.
- 715 • In years 7-10, RHIO-wide access controls will place more control into the patient's hands. The patient and providers will have strong identifiers and dynamic relationships that can be used to bind the patient's access control directives to each use. Built into this system will be fail-safe mechanisms to ensure that the critical patient data is available in case of emergencies.

720 Extending healthcare information outside the boundaries of an enterprise or even a single EHR system brings with it vast threats. This challenge, when properly designed into the system, can be met with a combination of policy, procedure, and technology. The goal of this Interoperability Roadmap is to protect both the safety and privacy through a balanced approach.

### **Enabling reliability, availability and recoverability**

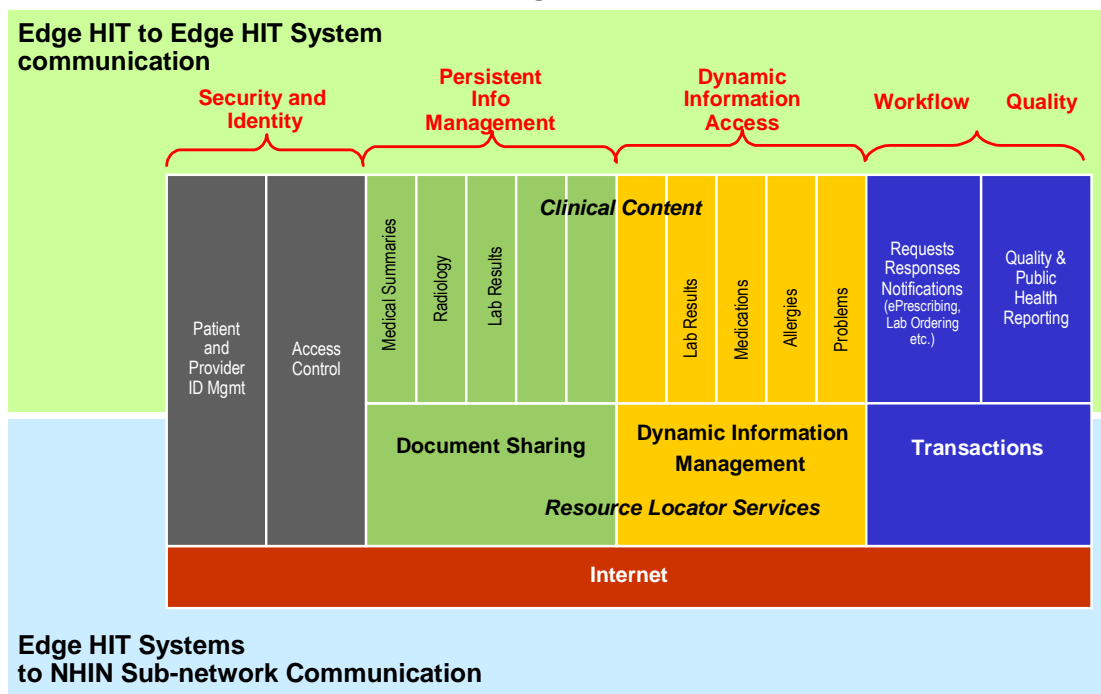
725 In terms of operational principles of reliability, availability and recoverability, this Interoperability Roadmap has been designed to support architectures that can meet the performance requirements of a paperless healthcare environment. EHRVA recognize that this critical level of operational service needs to cover not only normal operations but also a variety of degraded modes to ensure that software and hardware maintenance do not impact continued operations under any circumstances. These constraints need to be analyzed across a broader range of design issues than just the interoperability aspects of specific communication services. Hence, a complete response is well beyond the scope of this Interoperability Roadmap. Critical elements will be discussed in Section 5 structuring the target services.

730

## 6. Structuring Target Services

735 The previous Sections articulated the various building blocks of an interoperability framework. These represent a longer-term set of information exchanges services that will serve a broad range of use cases. Identifying the sets of information services that will support hundreds of use cases is the critical level at which this Roadmap is positioned. Identification of existing services that meet immediate use case needs versus services that will be developed over time, provides a working structure for demonstrating implementation levels of interoperability over time. EHRVA members' collective experiences have allowed us to organize these services around four major categories depicted in the following figure.

### Interoperability Target Health Exchange Service Model



740

Each of these four categories represents a set of services that supports a specific mode of health information exchange. Each reflects the information communication “contract” among the various communicating parties. These are represented vertically in the figure (red headings):

- Security and Identity
- Persistent Information Management
- Dynamic Information Access
- Workflow and Quality

745

The diagram shows that there is a separation of responsibilities

750

- Infrastructure, or lower, level as represented by the light blue background;
- Edge system-to-edge system as represented by the light green background

Information services, depending on their nature, may logically have responsibilities only in one communication layer, or they may have responsibilities distributed across both communications layers.

## Information Services

- 755
- Security and Identity (gray). The first category of communication services provides the means to secure health information as it is exchanged and stored (e.g. authentication, encryption, audit trail, access control) as well as the necessary information exchange services to properly identify consumers and care providers as they exchange health information (e.g. services to link patient identifiers). These services do not relate to clinical information, but are required to support the other three health information exchange services which are more clinical in nature. Please note that the Security and Identity category will be enriched in the future with vocabulary management services.

760

  - Persistent Information Management (green). This second category of communication services provides the means to exchange clinical information where the source needs to be held accountable to share a set of patient records as a group of closely-related health information (e.g. the prescribed medications associated with a recorded medical history and the known allergies at the time care was provided for the diagnosed problems). For the authoring source -- a physician office, a hospital, a pharmacy – these related items form a “whole” that include enough context to avoid misinterpretation by any receiver within the entire healthcare system, including consumers who may wish to preserve this record as part of their personal health record. We call this second set of information exchange services ***persistent information management***, because its fundamental characteristic is to allow the longitudinal aggregation of a health record with incrementally added content from uncoordinated multiple sources over time, with each source responsible for “persisting” their own contribution that represents a part of the truth about a patient’s health. Each increment is called a “document”, reusing an analogy from the paper world, because the context-rich health information may be structured and semantically rich in a standardized electronic format (e.g. XML). This category of service can manage any information content such as a medical summary (including problems, medications allergies, etc.), radiology reports or images, laboratory results, a genomic profile in the future, etc, as depicted in the figure by those smaller blocks. This service has a unique property in that the “contractual” relationship between the parties engaged is very simple and robust:

765

    - The *source of a set of documents* (a provider, a patient, a pharmacy, etc.) preserves this information at the time it makes it available “for sharing”. It is and will remain the steward of the “electronic” document’s content and accuracy.

770

    - The *infrastructure* preserves these sets of documents created at a point in time, and makes them available upon authorized requests. It supports replacement/addendum upon request by the original source.

775

    - The *consumer* (patient or subject of care) or any other *care/service provider* may access an attested copy of any of these documents, and choose to use any part of each one of these documents with knowledge of the context described in each document.

780  - Dynamic Information Access (yellow). This third category of communication services provides the means to request some portion of the most up-to-date clinical information (such as the most recent medication list, the know allergies, etc.) from remote health information IT systems. The source is accountable to respond to a request. The requester is responsible to interpret this information and to be conscious that a later query may result in different information being provided or that information may have different relevance depending on the source role in the health system. This complex but common situation is illustrated on the following example:

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*”A medication list being updated by a family physician and a cardiologist both prescribing*

*specific medications for different treatments. These need reconciliation with medications dispensed as documented by the pharmacy or health plan (off by a few weeks) as well as over-the-counter (OTC) medication by the patient.”*

805 If one issues a dynamic query to each one of these sources, one will be faced with taking a snapshot of each source of information in the midst of their respective workflows, making the aggregation of this information quite a challenge.

810 Dynamic information Access is a service commonly used in environments, such as an acute care facility, where the various sources of information and care provider teams have well-established workflows. Some use cases where timely and the most up-to-date information is needed from well-known sources are best addressed with these dynamic information access services (e.g. query of the state immunization registry). However, in environments with independent healthcare providers or service organizations, the use of such services may be prone to misinterpretation and may not be suitable for general deployment.

815 These services, which we call **Dynamic Information Access**, have a unique property in that the “contractual” relationship among the parties engaged varies depending upon the role of the information source:

- 820 ○ The *source of information* (a provider, a personal health record, a pharmacy, etc.) provides a snapshot of specific information at the time the request is received.
- The *infrastructure* conveys the request and the response and should not aggregate information from multiple sources which would jeopardize the effective use of the information by mixing information from different types of sources.
- 825 ○ The *consumer* (patient or subject of care) or any other *care/service provider* obtains response(s) to a specific request, but the access to the context of this information may require multiple queries with independent results that are not easy to link.

The use of these Dynamic Access Information Access services is quite attractive in environments where the information sought is known to be held in one specific information source.

830 Workflow and Quality (Blue). This fourth category of communication services provides the means to engage in cooperative work between the communicating entities. The main focus is no longer the sharing or access to health information, but the execution of distributed work in the context of specific workflows – for example, ordering a set of lab tests, and receiving results as those lab tests are performed, issuing a request for a prescription and receiving confirmation that the prescription has been dispensed by a pharmacy, issuing a notification for a bio-surveillance related event to a public health agency, or reporting a set of quality metrics to a performance management agency.

840 This category of communication services is specific to a precise set of tasks that require timely coordination among a well-defined set of partners that have agreed to be responsive to these transactions. This category of information exchange services has as a fundamental characteristic that, once an instance of a workflow has been performed, the information exchanged in the transactions generally need not be persisted in the form and content in which it was exchanged; only the conclusions of the workflow need to be recorded.

845 This fourth service category also supports a “contractual” relationship among the parties. These contractual relationships are specific to the types of workflows and bind these “consenting” parties for the time of the workflow which, by definition, has an agreed-upon conclusion.

## Separation of Responsibilities

To complete the presentation of the different types of communication services, there is a fifth type of communication service underlying the infrastructure through which those services move their “packets of information” in a reliable manner. These are depicted as this red layer called **Internet**. This is definitively a simplification, but is intended to convey that generally available standard telecommunication and media interchange IT infrastructures (e.g. CD-R, a smart card, or a USB key) are intended to be used. These will not be further discussed in this Roadmap.

Finally, in the background of the figure we have introduced the notion of “edge” healthcare IT systems (e.g. EHR systems, pharmacy systems, imaging center systems, PHR Systems, etc.) in contrast to the infrastructure (a sub-network of a broader national health information network). Edge HIT systems are primarily focused on delivering direct healthcare services to consumers, whereas health information sub-networks are intended to support the effective communications of among those edge HIT Systems:

- The upper level identifies for each of the category of communication services the part where the infrastructure sub-network is transparent and the communication involves peer interactions among edge systems.
- The lower level identifies for each category of communication services the part of the service where the sub-network infrastructure and the edge HIT systems cooperate.

In the scope section, this was introduced under the concept of a “thin NHIN”. We have also assumed that the NHIN is comprised of a federation of multiple sub-networks, just like the internet and intranets today, and thus we use the phrase “nationwide” health information network (NHIN) instead of “national” health information network. The fact that the infrastructure is transparent in terms of clinical content is very important, both because it drastically reduces the costs and operational complexity of the NHIN and of its sub-networks, and because it ensures that the complexity and evolutionary nature of clinical information that changes with healthcare delivery, vocabularies and technologies only impacts the edge systems and does not require massive ongoing re-investment in evolving the sub-networks.

Structuring the target services is not a theoretical exercise. It is critical to ensure that commonality of communication services is maximized across a wide range of use cases that are known today and will be identified in the future, as well as to ensure consistency within each one of the categories of communication services.

Having structured the target set of communication services, we can now establish the first steps of an Interoperability Roadmap, answering critical questions: “Where to start?” and “How can we extend without rework?”.

## Enabling reliability, availability and recoverability

As introduced in Section 4, it is critical to ensure that the operational principles of reliability, availability and recoverability have been taken into account in this Interoperability Roadmap.

First, the separation of responsibilities between the thin RHIN/NHIN level, and the edge system level contributes to making the RHIN/NHIN simpler (i.e., it has minimal clinical data awareness), therefore more reliable and available and requiring less frequent upgrades.

However, by shifting the burden to the edge systems, the problem persists if some edge systems become critical and their availability and maintainability cannot be ensured. In the case of digital document sharing, reliable access to patient record rests heavily on two systems:

- The document registry, clearly part of the RHIN infrastructure, is a central component that needs to meet high-performance and availability objectives which may be achieved with reasonable

890 ease by using the classic internet server techniques (redundant hardware, fail-over  
configurations, redundant network path with rerouting, etc., typical of a search engine service).  
The Document Registry is also a system that may reference any type of digital document with any  
type of information content so extension of content will not require upgrade of the registry or  
reconfiguration. Finally, from a performance standpoint, the simplicity of the registry content  
895 (about 20 attributes per document) will ensure rapid response, even with significant query traffic.  
In cases where there is no relevant document, it is a particularly important requirement that users  
experience less than two seconds response time. This is critical for care providers so that patient  
care may proceed quickly and with the confidence that no relevant information exists in another  
system. It is important to note that the definition of XDS registry attributes ensures that queries  
are sufficiently discrete and filling errors minimized.

900 • One or more document repositories, considered edge systems, need to be in an environment  
similar to the RHIN document registry, whatever the chosen level of centralization or  
decentralization (see Section 5, section e). However, one of the critical characteristic of XDS  
document repositories is their extremely simple functionality: store any digital document  
905 (regardless of content), place it in a file, assign a URL, and provide the digital document back  
unchanged in response to a single transaction for document retrieval. Such a simple document  
repository will need little software development and highly reliable implementations are available  
today. The decision to implement document repositories as shared edge systems (managed or  
not by the RHIO) or a dedicated system co-located with (or implemented within) the source HIT  
systems, is left to RHIO policy. This is one of the reasons that led EHRVA selected the IHE XDS  
910 document sharing approach for the Interoperability Roadmap

In the case of dynamic access services, achieving an acceptable level of availability and reliability will be  
a much more difficult challenge as information sources will require regular upgrades to source  
repositories and database schema when new types of clinical data are made available. This is why  
915 EHRVA has prioritized the use of such services in later phases of the Roadmap.

Workflow and quality communication services require different analyses. Indeed, in many cases only two  
edge systems are engaged in workflow communications (e.g. the generator of a lab order and a  
laboratory performing the lab work). In some cases, three parties may be participating (e.g. a prescribing  
system, an intermediary when the target pharmacy is not known at the time of prescribing and a  
920 pharmacy). Availability and reliability in these cases is primarily constrained by the specific edge systems  
supporting an instance of the workflow.

## 7. Delivering Solutions

925 In defining the first step of this Roadmap in January 2005, a number of communication services were identified as minimal but substantial to a useful starting point (in green in the table below). A number of gaps that require resolution for the next step were also identified.

### Phase 1: Share Care Status Information

930 We recommend that the first phase includes a solid basis for security and the cross-referencing of patient identifiers. We assessed a number of standards-based IHE Integration profiles in this domain and found them adequate and proven for their interoperability through implementation.

935 For clinical information sharing, it was clear that commonly used clinical information such as medications, allergies and problems has to be the initial focus in order to benefit the broadest range of care settings and impact significant quality and efficiency gains. This resulted in identifying the need for a medical summary, i.e., a core set of related health information about a patient's encounter with the healthcare system. In addition, the mode of communication of such medical summaries must be simple and empower providers and consumers equally to lower the barrier to technology adoption and increase utilization to achieve broad benefits for all stakeholders:

- 940 • Given that providers may be sensitive about sharing information with other providers, the source of clinical information has to be able to control the subset of the patient record it is willing to share and be assured that this information will be reliably provided through the IT infrastructure that links their computer systems (hospital, physician office, pharmacy, etc.) to those of other care or services providers. This infrastructure has to be "thin" in the sense that it does not compromise

#### Attestation from the Clinician's Point of View

Interoperable health care systems have the promise of providing much greater access to healthcare information for individual patients. While this information may provide benefit to all stakeholders in the health care system, one of its most important uses will be to facilitate direct, point of care healthcare delivery by providers. As important as access to healthcare information is in this process, equally important is the need to communicate to the potential user the quality and integrity of the information accessed. Large volumes of information of questionable source, processing or quality may require such time to validate before a provider can confidently use that information or the information is of no pragmatic value. In such cases, patient care may be hindered with a result that clinicians are less likely to access and use the information. It should be clear for a given collection of information the source, processor, creator, when the information was created and confirmation that this information has not been changed since the attestation. If amended or replaced by the creator, it should be made apparent to those who have accessed the information that the information has changed. Robust attestation services will be a key element of an effective interoperable health care system.

Clinicians have a responsibility to validate any information that they use in making clinical decisions regarding patients. If this is a cumbersome process, external information may not be used. At times, this may require a complete revalidation of the information in a step-by-step process to confirm information that has been obtained from another source, while at other times the content of a document will be accepted at face value based on the expectation that the person attesting the document can reasonably be expected to provide reliable information. Attestation implies that another clinical professional that I trust has been taught certain processes and has validated this information. Therefore the attestation of a given collection of information (here called a "document") is critical to the value of information both in terms of content, reviewability and point of care usability for a provider to be able to rapidly determine the value of that information. Though critical, it is no small endeavor and has been a critical factor is selecting document sharing as an exchange paradigm where attestation is most explicit.

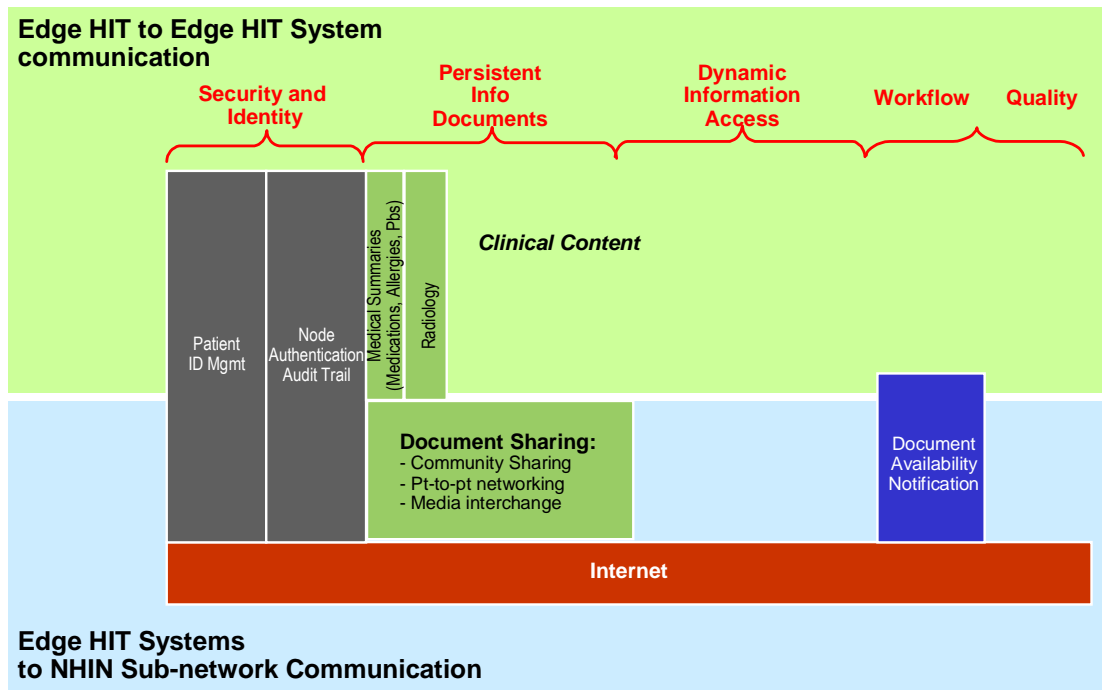
their contributed information.

- 945 • Equally, for care providers to use clinical information, the context in which the source systems produce this information has to be explicit (i.e. provider setting and identification, patient information, diagnoses and related medications, etc.). Trust in the information presented must be absolute, even if apparently conflicting or duplicate information is received.
- 950 • Persistent document sharing was clearly the starting point that would have the highest chance of adoption and empowerment of the two primary constituencies in health information exchange. Four specific interoperable communication services were selected and three gaps identified for attention in 2005. The plan to address those gaps was put in place through a collaborative process with the corresponding standards development organization (HL7) and integration profile development organization (IHE).

955 The sharing of imaging information (medical images and reports) was also accomplished in this first phase. This reflects the maturity and high-level of standardization reached by medical imaging (DICOM), as confirmed by most national IT projects around the world that are successful in deploying the imaging component of their national program (UK, Canada, etc.).

960 The successful implementation and testing of the first phase of communication services at the IHE North America Connect-a-thon where over 120 vendor systems were tested under supervision from the IHE user sponsors in January 2006 confirmed the validity of the services selected, their ease of integration in existing products, and the positive support from non-EHR vendors, who have an equally important role to play in the delivery of successful interoperability (e.g. IT Infrastructure, PHR systems, integrators).

## 2005-2006 Achievements *Realistic First Phase*



965 Each communication service identified in 2005 is further described in the table below, along with the key integration profiles (IP) and their maturity status. Further details on these specifications and the supporting standards are presented in Appendix E.

### EHRVA Interoperability Roadmap Phase 1

<b>Identification and Security</b>	
<i>Communication Service Use Case</i>	<i>Availability and Implementation Readiness</i>
<b>Patient identifier cross-referencing and Patient demographics query.</b> Patient/consumer identification between Edge HIT systems and master patient indexes (MPI).	Final IHE IP (ITI Tech Framework V2.0) Connect-a-thon 2005: > 20 implementations tested. US-CCHIT, Canada, France, Italy.
<b>Audit trail, node authentication and transport encryption</b> Establish a solid security foundation among the communicating edge HIT and infrastructure systems.	Final IHE IP (ITI Tech Framework V2.0) Connect-a-thon 2005: > 12 implementations tested. France, Italy
<b>Consistent Time</b> System clock synchronization	Final IHE IP (ITI Tech Framework V2.0) Connect-a-thon 2005: > 12 implementations tested.
<b>Persistent Information Sharing</b>	
<i>Communication Service Use Case</i>	<i>Availability and Implementation Readiness</i>
<b>Cross-enterprise document sharing</b> Infrastructure to publish a source persisted set of documents in a repository and reference them in a registry. Sources may query for specific documents, and retrieve them through their reference from repositories.	Final IHE IP (ITI Tech Framework V2.0) 2005 Connect-a-thon > 30 implementations tested. US-CCHIT, Canada, France, Italy.
<b>Cross-Enterprise Sharing of Medical Summaries.</b> Sharing of health summary information for physicians referral and hospital discharge.	Developed in 2005. IHE IP in trial implementation 2006 Connect-a-thon > 12 implementation tested.
<b>Cross-Enterprise Sharing of Imaging Information.</b> Sharing of imaging reports and images studies among imaging facilities and care providers.	Developed in 2005. IHE IP in trial implementation 2006 Connect-a-thon > 30 implementation tested. US CCHIT, Canada.
<b>Workflow</b>	
<b>Notification of Document Availability</b> Notifying a remote entity that one or more specific documents having been made available may be of interest.	Developed in 2005. IHE IP in trial implementation 2006 Connect-a-thon > 5 implementation tested.

970 In the course of 2006, all above Integration Profiles and supporting standards will be finalized (based on IHE Connectathon implementers feedback). The delivery of product implementation will then be possible, but will depend on a number of other factors such as the maturity of the markets that will build sub-networks (local, regional or disease specific), the national programs priorities, various incentive programs, etc. A number of these factors are beyond the responsibilities of EHR vendors. However, any RHIO

975 projects, aligning its interoperability strategy with this first phase should meet responsive EHR vendors. This is a critical success factor in any RHIO project, as the major interoperability challenge, does not rest with the building of an infrastructure, but with the interfacing of ten's, hundred's of EHR and other IT systems at the edges of the sub-networks.

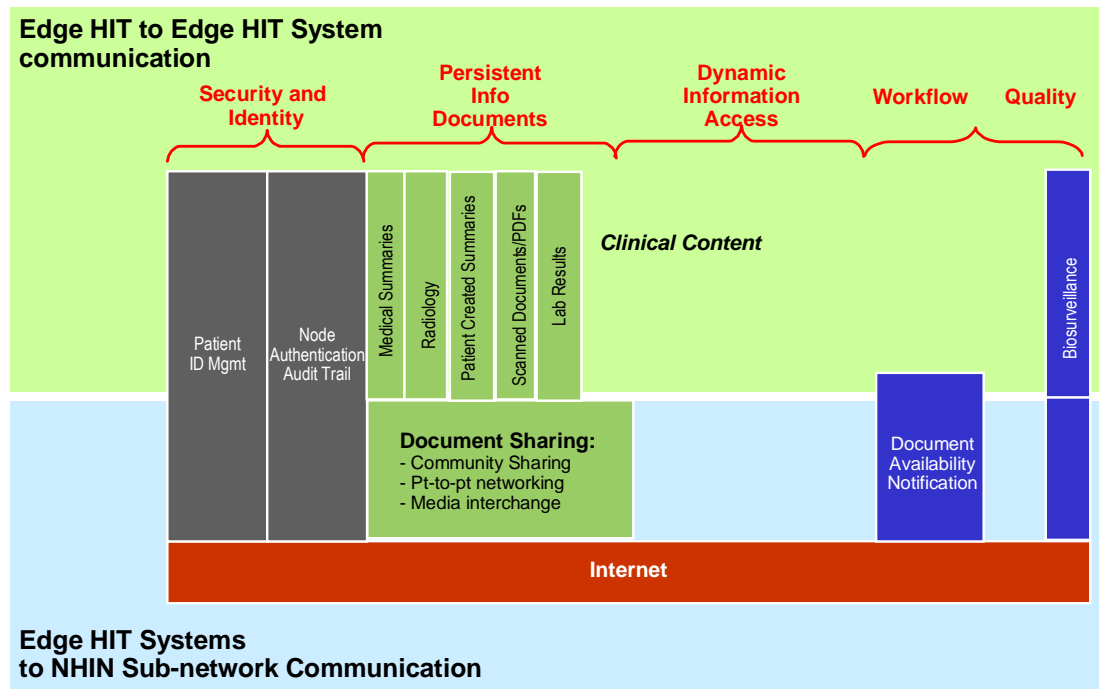
980 **Phase 2: Share Diagnostic Results and Therapeutic Information**

This second phase in the EHRVA Interoperability Roadmap was defined early 2006 with strong consensus of an even larger number of EHRVA members. The development of integration profiles and resolution of some standards gaps is to deliver “trial implementation” specifications in 2006. Following testing at an IHE Connect-a-thon, final specifications should be expected in 2007, enabling product release starting in 2007-2008, depending on market conditions.

985

This second phase further expand the breadth of document content with laboratory reports and consumer-created persistent health information (updated medication lists, patient identified allergies, etc.). These elements are depicted in the figure below, overlaid on the structure of communication services established for the target communication services.

**Phase 2 builds on Phase 1 achievements**  
*Realistic and Evolutionary Steps*



990

The communication services added in the table above rely on approved standards as well as standards close to finalization and committed integration profile development in IHE. The reinforcement of EHRVA cooperation with the standards organizations, in particular HL7 and ISO TC215, will build upon the success of this past year to deliver in a timely fashion high quality, implemented and tested integration profiles. This will be supported by strong commitment to engage the support of national initiatives in the USA (HITSP), as well as other countries, to ensure that globally acceptable integration profiles will be defined. Some national extensions may be required and will be designed into the global foundation.

995

The extensions to be developed in 2006 and delivered in 2007 are further described in the table below, along with the key standards, integration profiles, and their maturity status.

1000

**EHRVA Roadmap Phase 2 Additions**  
Building on 2005-2006 Phase 1 Success

<b>Identification and Security</b>	
<i>Communication Service Use Case</i>	<i>Availability and Implementation Readiness</i>
<b>Patient identifier cross-referencing and Patient demographics query.</b> Patient/consumer identification between Edge HIT systems and master patient indexes (MPI).	IHE IP committed to development for ITI Tech Framework V3.0)  Leverages Canada & Netherlands
<b>Federation of XDS Domains</b>	To be developed in 2006.
<b>Persistent Information Sharing</b>	
<i>Communication Service Use Case</i>	<i>Availability and Implementation Readiness</i>
<b>Cross-Enterprise Document Interchange</b> Point to point interchange, either on physical storage media (CD or USB), or through document sets secured e-mail "push".	To be developed in 2006.
<b>Sharing of Patient Created Summaries.</b> Support consumers' ability to input and share their own health information with other healthcare entities.	To be developed in 2006.
<b>Sharing of Laboratory Reports.</b> Share laboratory results (sets of laboratory tests ordered and have been performed and validated). See Note	To be developed in 2006.
<b>Sharing of Scanned Documents.</b> Sharing of scanned paper documents with other healthcare entities.	To be developed in 2006.
<b>Claim Attachments of Scanned Documents</b>	To be developed in 2006
<b>Dynamic Access</b>	
<b>Query Immunization Registry</b>	Profiling incomplete and Connect-a-thon testing needed.
<b>Workflow &amp; Quality</b>	
<b>eRX</b>	Profiling incomplete and Connect-a-thon testing needed.
<b>Ordering and real-time receipt of Lab Results</b> This Communication Service addresses the on-line ordering of laboratory work (on some sample) and the real-time sending of results (partial or complete). See Note.	To be developed in 2006.
<b>Bio surveillance Lab Notifications</b>	Available - Needs Connect-a-thon testing
<b>Bio Surveillance Info Entry</b>	To be developed in 2006.
<b>Clinical Trial Capture</b>	To be developed in 2006.

Notes on access to laboratory results.

1005 This Interoperability Roadmap distinguishes two communication services for accessing laboratory tests results:

- The first one is the service that enables a care provider to order lab tests (e.g., from the local EHR) and to receive the results as soon as released by the laboratory (e.g., from a lab information system). Results are received "real-time" by a connected receiver system (e.g., an EHR system).
  - The second service (sharing laboratory reports) addresses the sharing of previously ordered and released laboratory tests results.
- 1010

Based on this distinction, the EHRVA Interoperability Roadmap proposes first the upgrade of the myriad of HL7 V2.x lab interfaces to a consistent HL7 V2.5 (the first version with robust error reporting), sharing

1015 the same “extended LOINC” as the one defined above for laboratory reports sharing. A migration to HL7  
V3 messages is not practical until the disparate installed base of HL7 V2 lab interface has been  
rationalized, both in inpatient and reference labs. A significant part of the HLV2.5 profiling work has been  
done by IHE with the Lab Scheduled Workflow Integration Profile and ELINCS. Harmonization of the two  
integration profiles will benefit both groups, which are engaged in discussions to merge their activities.  
We expect to see progress in 2006 to deliver an harmonized EHR-to-lab integration profiles and a lab  
report sharing integration profile for January 2007 Connect-a-thon testing. CCHIT (EHR-to-lab) and now  
1020 AHIC (Lab Report Sharing) need this work to proceed to meet their EHR certification requirements and  
identified use cases.

### Phase 3: Advanced Access Control and Clinical Decision Support

1025 With this third phase one enters into the broad coding of information exchanged, either via document  
sharing or in the cases where a dynamic access to selected sources is more efficient. A widely available  
and more advanced user access control can also be introduced which provides increased flexibility to the  
consumer in managing access permission to own health information.

This third phase includes the following Communication Services:

1030 **Security:** User access control - extend existing authentication mechanisms to include role and content  
specific rules using SAML<sup>P</sup> as the basis for the profile. Currently, there is no common definition of  
authentication and role provision among EHR systems.

**Security:** Consumer Permissions - Enable consumer to opt in or opt out of the HIE and control which  
types of data are available to which user roles. SAML may also be the basis of this profile

1035 **Document Sharing:** HL7 CDA and ASTM CCR - harmonization of the ASTM CCR into HL7 CCD as an  
addition to XDS-MS. This would add structured vocabularies and content for vital signs, immunizations,  
etc.

1040 **Document Sharing:** Consumer data for disease management of the top 10 chronic diseases account for  
80% of health plan costs (e.g., diabetes, asthma). Engaging patients and providers in an interactive  
process has resulted in dramatic decreases in the cost of caring for these diseases as well as  
improvements in patient satisfaction and quality of life.

**Dynamic Info Access:** Medication List Management - Create and maintain an active medication profile  
based upon ordering providers, dispensing pharmacies and health plan claims data. Reduce unknown  
drug interactions from multiple providers as well as reducing fraud and abuse.

1045 **Dynamic Info Access:** Allergy List Management - Create and maintain an active allergies and  
sensitivities list for use by providers and pharmacies which can be combined with Dynamic Medication  
List Management to improve patient safety in the prescribing process. Allergic reactions are the number  
six reason for reported adverse drug events.

1050 **Workflow:** Radiology Orders and results - Like Laboratory orders and results, an integration profile for  
diagnostic imaging orders and results would reduce implementation costs and improve interoperability  
between EHR systems and DI centers.

**Quality:** Performance Reporting (lack of standards) - the impact of pay for performance and other  
qualitative initiatives on physicians can be greatly reduced by using a standardized data  
exchange/reporting integration profile between health plans and providers.

**2. 7.4 Phase 4: Collaborative Care, Active Quality Reporting and Health Surveillance**

1055

Such workflow extensions can now be deployed as the basic information exchange and main ancillary services access have been addressed. The list below identifies some key workflows (the list is probably not exhaustive) now possible, given the level of diffusion of IT capabilities across the health system.

1060

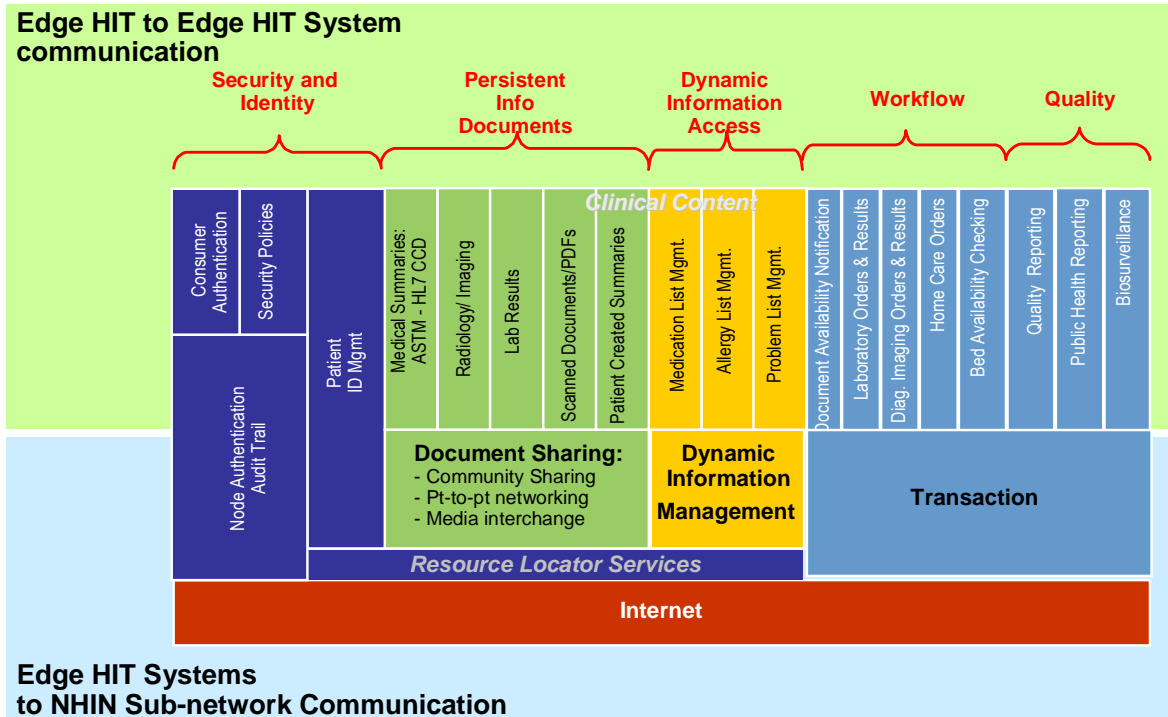
**Dynamic Info Access:** Problem List Management - Create and maintain and active problem list which is shared among providers and other appropriate providers. Problem lists can be critically important in reducing adverse drug events.

**Workflow:** Referrals to consulting physicians and consultation reports. Similar to Laboratory and Diagnostic Imaging workflow profiles, consult order and reports integration profile would reduce costs and improve interoperability between EHR systems.

1065

**Workflow:** Order signature by MD, for orders entered by HomeCare/VNA. Unlike DI and Laboratory orders for home care patients are often originated or suggested by the in home provider and then officially signed by the responsible physician. An integration profile addressing this workflow would reduce the need for physicians to transcribe or re-enter orders for this setting of care.

**EHRVA Interoperability Roadmap  
 Phase 1, 2, 3 & 4**



1070

**Workflow:** Bed Availability Checking - Physician offices often must call a hospital prior to patient admission to determine bed availability, especially for non-urgent procedures. An integration profile between hospital bed management systems and physician office EHR systems would reduce costs and improve workflow.

1075 **Dynamic Info Access:** Medication List (PHR to EHR) - consumers/patients often take over the counter medications, which are rarely documented in any provider's EHR. Connecting the consumer PHR to the Dynamic Medication List will improve the quality of care and reduce adverse drug effects that these OTC medications often cause.

1080 **Workflow:** orders for DME - when physicians write orders for durable medical equipment or medical supplies, these orders must be printed and faxed to the supplier and/or patient. An integration profile connecting EHR systems and suppliers would reduce costs and improve workflow.

1085 **Workflow:** Public Health Outbreak alert notification - Once the flow of data into public health organizations is improved, it will be necessary to improve the notification and case management system for tracking and treating effected patients. An integration profile between public health organizations and physician EHR systems, will improve general notifications of possible outbreaks as well as identification of specific patients, which may need to be treated and tracked. It is expected that by 2010, a significant share of bio-surveillance may be performed by data mining (through registry traversing) at regular interval (hourly, daily), newly contributed patient summaries, abnormal diagnosis frequencies, lab result values, etc.

## 8. Progress Based on Collaboration and Results

1090 EHRVA members are actively engaged in national and global efforts to provide interoperability solutions, and many of the proposed Roadmap services that are in place or under advanced development reflect the existing collaborative efforts of standards development organizations, professional societies, the vendor community, public sector organizations and country-specific initiatives.

1095 At the 2005 HIMSS Conference IHE Cross-Enterprise Showcase, 14 companies, including 7 EHRVA members, demonstrated the document sharing health information exchange concept, such as the exchange medical summary information, lab reports, static text reports (PDF's) and structured information. The product demonstrations focused on use-cases that would enable "plug-n-play" interoperability of clinical information that patients and clinicians utilize in typical medical settings.

1100 In the Spring 2005, 16 European vendors participated to the IHE-Europe Connect-a-thon for cross-enterprise information exchange. Participants were amazed with the power and efficiency of the IHE Cross-Enterprise Document Sharing (XDS) and associated Integration Profiles that achieved connectivity between hospital and physician office EHR Systems that never had communicated before, even products used in different European countries.

1105 In 2005 the first federated health information exchange using the IHE Cross-Enterprise Document Sharing (XDS) profile was launched in an Italian region serving 5M lives.

1110 EHRVA, in partnership with HL7, IHE and HIMSS launched the IHE Patient Care Coordination Domain in April 2005. Using the proven IHE collaborative development model, the Patient Care Coordination team of vendors and clinicians representing multiple disciplines, developed fundamental medical summary profiles to support outpatient referrals and inpatient discharge use-cases. These profiles will be demonstrated at the upcoming IHE Interoperability Showcase at 2006 HIMSS Conference by over 23 IT vendors and the Department of Veterans Affairs – 9 months after the team was launched!

1115 In addition to demonstrating medical summary information exchange, the 2006 IHE Showcase will also demonstrate services identified in the Roadmap presented in this document to ensure the security and privacy of health information exchanged, as well as services that provide basic building blocks to support clinical messaging and exchange of other clinical data such as medical imaging information.

Given the provider leadership of IHE, in 2006 the ACC and RSNA will provide substantial demonstrations of many of the Roadmap services, focusing on health information exchange that enables quality, safety and workflow efficiency in cardiology and radiology.

1120 These implementations and user supervised testing activities have removed most of the technical gaps  
for building information exchange that can accelerate and enhance the AHIC use cases. The EHRVA  
Interoperability Roadmap is also complementary to the health information exchange initiatives underway  
in Canada, France and other EU and Asian countries, with regional deployments slated for 2006 and  
2007. The deployment of these Roadmap services in several countries in addition to the growing global  
1125 vendor support provides powerful and relevant proof statements for government policy makers and  
regional health information organizations in the United States.

The underlying interoperability building blocks of this Roadmap have been recognized by the Global  
Health IT Summit organized in Japan in September 2005 and to which Dr Brailer and other leaders of  
national projects contributed by engaging the International Standards Organization (ISO) and its partner  
standards development organizations to accelerate the efficiency of delivering more readily applicable  
1130 standards. As a follow-up, ISO TC 215 has asked IHE to establish a liaison and is proposing to endorse  
the IHE process and the existing IHE Integration Profiles as ISO Technical Reports. The EHRVA strongly  
supports these healthcare professional led collaborative efforts involving standards development  
organization, HIT vendors and national initiatives, and recommends that Integration profile development  
should continue to be conducted as a global activity, by expanding the IHE initiative and given its  
1135 relevance, openness and efficiency. The multi-billion dollar investments needed in standardizing,  
implementing and deploying such connectivity at the national level is most efficiently and expeditiously  
conducted at the global level, when solid processes are applied by the primary stakeholders.

## 9. Conclusions and Call to Action

### 1140 Enabling the Transformation

Medical knowledge and technology are expanding at an incredible rate, making it difficult for the  
healthcare providers and implementers to keep pace. Increasingly, The demands of a growing population  
of patients, advances in medical care and advances in technology are creating a shift from the treatment  
of a single, acute problem to the long-term management of multiple, interrelated chronic conditions.<sup>1</sup> In  
1145 addition, recognizing the need to move away from a high cost, reactive approach to healthcare delivery to  
a more proactive, consumer empowered health management, additional stress has been put on  
healthcare delivery system to provide accessible and meaningful information to consumers and patients  
to make informed personal health decisions. These changes make it more important than ever to have a  
clear Roadmap, with stringent guidelines, standards, and timelines to move forward in seamlessly  
1150 exchanging information at the point of care and sharing this information to improve quality and care for  
the individual and the public in its totality. Although we have the information, experience and technology  
to support health information exchange, this path will not be without its challenges. It is important to  
recognize these challenges proactively and plan accordingly.

The collaborative efforts of competitors in the healthcare marketplace, comprised of architects, providers,  
1155 clinicians, policy developers and many others with diverse backgrounds in technology and healthcare,  
have come together with the Electronic Health Records Vendor Association to offer this Roadmap to  
further define interoperability in healthcare. We present this Roadmap, having thoughtfully reviewed each  
component, with the focus on the value of incremental interoperability, so as not to overburden an already  
overwhelmed healthcare delivery system.

1160 This Roadmap not only reflects our roles as healthcare technology solution providers who have a vested  
interest in improving the safety, quality and efficiency of the health management process for the

1165 customers we serve, but it also reflects our vested interest as patients and consumers and the communities in which we live. Improving interoperability in healthcare is a journey and the EHRVA Interoperability Roadmap reflects the purposeful steps we collectively believe will enable the transformation we all seek to achieve.

1170 At the January 17, 2006 meeting of the American Health Information Community, HHS Secretary Michael Leavitt noted that the greatest challenge in creating a nationwide health information network will be in dealing with the “sociology challenges”, not the “technology challenges.” Access and ownership of patient data, privacy and security are important interoperability policy matters that are not addressed specifically, but are taken into consideration in the Roadmap where technology is an enabler to their effective implementation.

1175 The Roadmap is derived from our collective experience from working with our customers, who implement this technology on a daily basis. We know and understand what our customers are capable of doing and accomplishing, and we work with our customers to help solve their problems every day. This is an extremely important influence, not to be overlooked as we move forward with these initiatives. Many factors influence their pace of implementing technology. These barriers include: financial limitations, infrastructure readiness and cultural acceptance – change is difficult. It just needs to be the right time with the right technology at the right price.

### 3. Open Engagement, Collaboration and Consideration

1180 The EHRVA understands the increased costs to the healthcare marketplace if multiple Roadmaps are mandated, or even worse, if multiple Roadmaps are put on the table and begin to be implemented in pocket areas, creating interoperability divergence instead of convergence.

1185 We understand that there is a minimum timeframe in which all of this can be accomplished, and that trying to do it faster will actually delay the end result, rather than accelerate it. This is not to say that a fair amount of pressure is good, only that setting unrealistic timeframes always produces a bad result.

We would like to see harmonization and collaboration among all of the entities now involved to define the future of “interoperability.”

1190 Open dialogue with all stakeholders is necessary in order to understand the value, contributions and benefits each brings to the effort. As a whole, the industry is committed to improving care and lowering costs. It is critical to engage all areas, rather than isolating or undervaluing their contribution. Any effort should include all healthcare stakeholders, including vendors, and position each as a valued contributor.

We present and ask you:

- Include the vendors in all relevant dialogues
- Develop realistic and useful "use cases" and first steps
- 1195 • Harmonize all national initiatives and the EHRVA Roadmap
- Understand the EHRVA Interoperability Roadmap, and allow us to explain why we are recommending this particular strategy.
- Understand that this Roadmap represents standards and integration profiles already tested in the real world... and around the world.

### 1200 4. Pragmatic business case driven planning

As we work toward implementation of a personal electronic health record for every citizen, we must take into consideration the tactical path required to support this journey. If clear operational and clinical benefits are not achieved with each stage of implementation, we are destined to fall short of our goal. The healthcare community is under extreme financial burden and unlike other industries can not simply

1205 choose to not provide services. Therefore, we must take into account the financial realities in which we operate and provide a plan that meets relevant, urgent needs with reasonable and achievable methods. Not only will this provide incremental benefit; it will also serve to spur further adoption of technology. It is only when we can positively answer the question – “how is this better for patients and consumers” that we will see adoption become organically driven within the healthcare community.

1210 While the Roadmap focuses on the interoperability of clinical health information, EHRVA recognizes this is a highly interdependent healthcare delivery system. Proposed or planned changes to coding systems, mandated vocabularies and claims processing must be implemented in a coordinated fashion via thought review and planning by the public and private sector stakeholders.

## 5. Evaluation and Convergence of the Roadmap Elements with National Initiatives

1215 It is imperative that the combined resources and efforts of the private and public sectors be intentionally aligned. The risks of selecting a healthcare IT interoperability strategy which does not have broad EHR vendor support include:

- 1220 • Higher market costs for product upgrades when implementing connectivity. Over 90% of implementation costs will be at the boundary between the infrastructure and the Edge HIT systems (thousands of different systems, many thousands units), not within the infrastructure itself.
- Delayed implementation timeframes, leading to lost benefits.
- Creating an isolated approach which will not support accelerated deployment in areas requiring a global market approach.
- 1225 • Introducing untested standards and integration profiles, which will further delay implementation timeframes and benefits.

1230 Never before has the industry been more readily poised to transform healthcare using health information technology. The years of experience and expertise provided by the members of EHRVA provide a perspective, which include a critical and thoughtful evaluation of our previous efforts to achieve health information exchange. This review provides us with insights on what barriers, risks and challenges prevented the success of earlier efforts, such as those implemented in the early 1990s.

1235 Significant changes have occurred in the industry that have altered the environment in which we attempt to transform healthcare. Significant of these changes has been government policy initiatives, first in the UK, then followed by Canada, EU countries and finally the United States, that all recognize the importance of transforming healthcare as a national strategic imperative. Common to all these national healthcare initiatives has been the recognition of information technology as the enabler for transforming current healthcare delivery systems.

1240 In the United States, a parallel effort to the government led initiatives emerged in the private sector that recognized the opportunities for significantly improving healthcare delivery within a community, spurring the accelerated development of multi-stakeholder based health information exchanges. These local efforts were able to leverage the substantially lower cost for creating the infrastructure to enable these exchanges using the widespread adoption and deployment of Internet-based technologies and architectures. The need to create community-wide infrastructures has become more apparent in the wake of natural disasters that have highlighted risks of paper-based healthcare delivery and the need for increased level of public infrastructure to support healthcare delivery during and after natural or other large-scale disasters. Interoperability efforts in the health IT industry have matured substantially, as providers have invested to improve workflow beginning at the department and enterprise levels, causing vendor’s to shift from proprietary, closed system designs and providing solutions to allow customer’s to cost-effectively integrate silos of information to improve quality, cost and safety. This trend led to the creation of multi-stakeholder initiatives to address interoperability at the enterprise level, and these valuable lessons are now being applied to providing interoperability solutions that span multiple care providers, payers and patients.

1255 The potential for increased consumer involvement in their healthcare management may influence Interoperability Roadmap efforts the most. With over 66% of all households connected the internet<sup>2</sup>, the expectations on the healthcare market to provide the same marketplace transparency to consumers as the Internet has for practically all other industries are growing, and could accelerate as consumer's burden for paying for the cost of healthcare increases.

1260 The growing healthcare policy alignment in the private and public sectors and the increased recognition by all stakeholders that the seamless exchange of health information whenever and wherever it is needed to provide safe, effective and high quality care is an essential requirement of the healthcare system, provides the appropriate backdrop for transformation to occur. Armed with the experience, stakeholder engagement, technology and desire, we can transform healthcare for the benefit of all patients, including ourselves.

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<sup>2</sup> Broadband Adoption at Home in the United States: Growing but Slowing, John B. Horrigan, Pew Internet & American Life Project, Presented at 33<sup>rd</sup> Annual Telecommunications Policy Research Conference, September, 24, 2005.

## Appendix A – Definition of NHIN, RHIN, HIE, sub-network, RHIO and SNO.

1270 In this document, the use of the terms NHIN, RHIN, HIE, sub-network, RHIO, SNO assumes the following meanings:

- The **nation-wide health information network (NHIN)** is an infrastructure to which edge systems (e.g. EHR systems, laboratory information systems, personal health records systems, etc.) are connected and by which exchange health information.
- 1275 • The nation-wide health information network (NHIN) is structured as a number of sub-networks interconnected through an NHIN backbone. A **regional health information network (RHIN)** is an example of a sub-network defined by its geographical area. Some sub-networks may be defined by other “affinities” shared by the edge systems, such a specific disease, a research project, etc.
- 1280 • A **NHIN sub-network** is managed by a sub-network organization (SNO). A RHIO may group one of more SNOs, each managing their sub-network, in a geographical area. RHIOs may be formed one or more SNOs.
- A **health information exchange (HIE)** is made of one or more sub-networks interconnected through a backbone, and the edge systems it connects.

1285

## Appendix B – Defining a digital document

The term “document” utilized throughout this Roadmap is in context of an “electronic” use, not in the sense of a traditional paper document. Characteristics include:

- 1290
- Produced by a single source (e.g. a consumer, payer, pharmacist, provider, etc.).
  - Grouping of related health record elements which form a whole attested by the source.
  - Computer processible structured data (e.g. meds, allergies, diagnoses).

This contains a subset of information that is the patient health record and is the information known at the time of the care event for which it is being created. Examples include:

- 1295
- Encounter medical summary
  - Discharge summary
  - Approved diagnostics (e.g. lab, imaging) report
  - Dispense medications

1300

Each source of information (e.g. provider, consumer, pharmacy) may release such “documents” containing “known facts” by the source at the time they were released. This empowers the source of information to select and attest to the information it shares. The user of the information understands with confidence the context in which this information was persisted and attested.

1305

### **Benefits:**

This method allows:

- Clarification of responsibilities
- Bounded, validated set of health information contributed to a patient health record.
- 1310 • Crisp context to evaluate and trust this set of information (or digital document).

Aggregation of content across documents from different sources is the responsibility of the user of the information. It is safely managed by the application under the direct supervision of the user of the information (PHR systems, EHR system or any other IT systems).

1315 Digital document sharing is a pragmatic and valuable first step toward an interoperable electronic health record, which is easily implemented and provides relevant, valuable sharing of information electronically meeting today's needs.

## **Appendix C – HL7 Information Models and integration of standards efforts**

1320 Whereas the HL7 reference Information Model (RIM) is highly valuable in integrating domains and standards across healthcare at the abstract standards development level, the work of implementers focuses on very concrete, constrained information models derived from the HL7 RIM. For example, HL7 allergy and adverse reaction information models are derived from the RIM and use to create the XML structures used in the Allergy sections of electronic documents and messages. From a practical point of view, it is these XML structures in messages and documents derived from the RIM that are actually used to exchange information that will populate the EHR with terms, codes, dates, authors, and other structured data elements. In many cases, such as in IHE, the Integration Profiles developed from these RIM-based structures provide a precise definition of specific elements of information exchanged.

## **1330 Appendix D – Achieving the value of Interoperability**

The following Appendix starts form a real-world scenario proposed by the Commission on Systemic Interoperability, and associates with each step of the transformation, the specific communication services defined in this Interoperability Roadmap.

### **Today**

1335 Dr. Ernesto Africano<sup>3</sup> is a specialist who uses an electronic health record (EHR) system in his solo office. The system helps him keep track of his patient's progress, saves him time, and ensures that patient records are legible and easy to share with his patients' primary care doctors after they come to see him. The biggest benefit he sees is being able to provide better, more efficient healthcare to his patients because the information is accessible and complete, easy to read, immediately updated by and available to other caregivers. But he has been frustrated that more offices and labs are not able to connect to this office either because they don't have EHRs or because their EHRs are not interoperable with his system. He still has to maintain paper charts because of the volume of information he receives via fax and "snail mail".

1345 "We get a number of requests for copies of medical records from other physicians and my handwriting is not the most legible, even to myself, so I felt that having very clear, legible records was a definite benefit in organizing my information and patients' charts, and being able to generate reports, letters, and photocopies of reports for other physicians and agencies requesting the medical records, which is almost a daily occurrence." But even while Dr. Africano is able to share his notes and charts with other offices, he still receives all his lab test results, x-rays and consultation letters on paper. They then either have to be scanned into his EHR or manually entered which is very time-consuming for his staff and potentially compromises the quality of care for his patients.

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<sup>3</sup> Scenario based on: "Ending the Document Game - Your Healthcare Through Connecting and Transforming Information Technology, Commission on Systemic Interoperability, 2005, Provider Stories: Impossible to Achieve Total Interoperability, Ernesto Africano, Suburban Maryland."

1355 Dr. Africano wishes he could connect with other offices and the hospital, but without interoperability of electronically-structured information, he must continue sifting through paper charts to find information he needs. "I would absolutely want to connect to laboratories and pharmacies, so instead of having to print out and sign or fax prescriptions or give them to patients, I would be able to e-mail prescriptions, receive or search lab reports, send information electronically to other doctors, or receive existing medical records on my patients when they are referred to me. That is where we're headed in the future."<sup>4</sup>

## Two Years Later

1365 Dr. Africano's EHR vendor just helped him upgrade his system to the latest version of software. Dr. Africano is especially pleased that the new version of the software will help him become increasingly efficient.

1375 Many primary care practices now have EHRs, and the hospital, labs and pharmacies are increasingly electronic, so he will now be able to send and receive patient medical record information electronically when patients are referred to him by primary care physicians. He can manage most patient prescriptions electronically, receive patient lab results immediately and populate his EHRs automatically with information he needs to make patient care decisions. Dr. Africano is now able to rapidly obtain aggregated views of patient histories, scan through, and identify key information for more detailed assessments of specific documents because this information is stored and received in his in a semi-structured form. He admits that there will be still some paper that he must manage but the decreasing volume makes it more affordable scan this information into patients' charts -- although scanned documents are not as easy to review as the rest of the electronic record.

### Roadmap Phase 1 & 2

**The time is late 2008 – early 2009.** EHR products have allowed a significant number of providers to implement some of the communication services. (See Section 5 for the 2006-2007 component of the EHRVA interoperability Roadmap). Dr Africano runs one of those physician practices.

- Document sharing of medical summaries, referrals and discharge summaries
- Workflow for eRX (*on-line transmission of prescription and refills*).
- Workflow for real-time lab orders and results via *on-line connection to specific labs*.
- Document sharing for access to imaging reports and studies, including *radiology reports and rad/cardio images*
- Document sharing for access to prior lab results that *can be searched for specific tests and trending*.
- Notification of document availability *when referrals or radiology reports are made available to enable Dr Africano's staff to review ahead of patient arrival*.

1415 But his office is almost paperless. "This step means a lot to my practice and my patients. Patients are expecting me to use electronic health record technology to manage their care, being comfortable that I have more effective access to their information and better knowledge of their problems without them having to repeat their medical history to me. Interoperability that enables me to exchange medical record information electronically with other practices and hospitals makes it possible for me to have a comprehensive view of my patients' medical histories no matter where they receive care. My patients benefit because I have the information I need to help them make the best care decisions and the tools to help patients receive the care that I prescribe. I'm really excited about being on the road to achieve real

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<sup>4</sup> Scenario based on: "Ending the Document Game - Your Healthcare Through Connecting and Transforming Information Technology, Commission on Systemic Interoperability, 2005, Provider Stories: Impossible to Achieve Total Interoperability, Ernesto Africano, Suburban Maryland."

interoperability and pave the way to higher levels of collaboration to take better care of patients in our community.”

## Five Years Later: TRANSFORMATION

1425 Dr. Africano’s practice has clearly benefited from his EHR system. “You know, I still miss a lot about the  
way medicine in “the old days”, but there is no question that there’s less drudgery than a few years ago.  
With the most recent version of my EHR system, I’ve been able to make the transition to a more effective  
operation. I clearly see the benefits of having all critical information in my office available electronically.  
As a result, my productivity has increased and I’m able to see more patients with more complex problems.  
1430 The primary care physicians know this, so my referral business is increasing; I’m even considering adding  
a partner.”

1440 “More importantly, patients are becoming more involved in their own care. Many of my patients  
schedule their appointments on-line and supply me with medically-related information from  
their personal health record before they arrive at the office. This, in combination  
1450 with my ability to access encounter information from other providers has led to my being able to more  
quickly assess patients and have more time to really talk with them when they’re  
here for their visit. Patients are even accessing the instructions that I give them  
1470 through their personal health records services, I also place radiology orders electronically and follow in real-time my patients  
1475 when they’re admitted to the nearby community hospital.”

### Roadmap Phase 3 & 4

The communication services from the EHRVA Interoperability Roadmap (see Section 5 for details) have been delivered in 2011 as part of the installation of a new version of Dr Africano’s EHR product. It has brought enhanced interoperability to Dr African and his patients:

- Document sharing for patient-created summaries with patients’ annotations and record of self-care.
- Document sharing for continuity of care documents, i.e., a *harmonized HL7-ASTM document with consistently coded information (SNOMED, NDC, etc.)*
- Workflow to support basic quality reporting and *on-line connection to specific labs.*
- Workflow for dynamic queries for meds/allergies/problems, *available to follow time critical patient care.*
- Workflow for radiology and other orders.
- Workflow to support advanced biosurveillance.

1480 “The most recent version of the EHR gave me even better capabilities to monitor the quality of care that I provide to my patients with decision support at the point of care as well as reports that show various quality measures on patient populations that I care for. And, simply as a byproduct of using the EHR to care for my patients and document their care, the quality measures required by insurance companies’ pay-for-performance programs are captured and passed to my billing system. The EHR also automatically captures and reports most surveillance data needed for public health surveillance and reporting.”

1485 “Yes, times have changed. But without these changes, I know that I could not have kept pace with expectations that I provide the best in evidence-based medicine for my patients. It’s my patients’ and colleagues’ confidence in me and the fact that I can make a difference that makes this worthwhile.”

## Appendix E – Roadmap Selection of Standards and Integration Profiles for Phase 1 & Phase 2

1490 This Appendix provides for each Communication Services, a detailed specification of the Integration Profile supporting them. It also identifies the standards on which these Integration Profiles rely.

### EHRVA Interoperability Roadmap Phase 1

Identification and Security			
<i>Communication Service Use Case</i>	<i>Base Standard</i>	<i>Integration Profile (IP)</i>	<i>Availability and Implementation Readiness</i>
<b>Patient identifier cross-referencing and Patient demographics query.</b> Patient/consumer identification between Edge HIT systems and master patient indexes (MPI).	HL7 V2.5 (evolving to HL7V3 in 2006-2007)	-IHE PIX Integration Profile -IHE PDQ Integration Profile	Final IHE IP (ITI Tech Framework V2.0) Connect-a-thon 2005: > 20 implementations tested. US-CCHIT selected, Canada, France, Italy.
<b>Audit trail, node authentication and transport encryption</b> Establish a solid security foundation among the communicating edge HIT and infrastructure systems.	IETF RFC 8366 (approved by HL7, DICOM and ASTM) IETF – TLS X.509 certificates	IHE ATNA Integration Profile	Final IHE IP (ITI Tech Framework V2.0) Connect-a-thon 2005: > 12 implementations tested. France, Italy
<b>Consistent Time System</b> clock synchronization	IETF NTP	IHE CT Integration Profile	Final IHE IP (ITI Tech Framework V2.0) Connect-a-thon 2005: > 12 implementations tested.
Persistent Information Sharing			
<i>Communication Service Use Case</i>	<i>Base Standard</i>	<i>Integration Profile (IP)</i>	<i>Availability and Implementation Readiness</i>
<b>Cross-enterprise document sharing</b> Infrastructure to publish a source persisted set of documents in a repository and reference them in a registry. Sources may query for specific documents, and retrieve them through their reference from repositories.	ISO-OASIS ebXML Registry	-IHE XDS Integration Profile	Final IHE IP (ITI Tech Framework V2.0) 2005 Connect-a-thon > 30 implementations tested. US-CCHIT selected, Canada, France, Italy.
<b>Cross-Enterprise Sharing of Medical Summaries.</b> Sharing of	HL7 CDA Rel 2. HL7 Care Record	-IHE XDS-MS Integration Profile	Developed in 2005. IHE IP in trial implementation

health summary information for physicians referral and hospital discharge.	Summary HL7 V3 Meds, Allergies, Pbs.		2006 Connect-a-thon > 12 implementation tested.
<b>Cross-Enterprise Sharing of Imaging Information.</b> Sharing of imaging reports and images studies among imaging facilities and care providers.	DICOM images and structured reports Text and PDF	-IHE XDS-I Integration Profile	Developed in 2005. IHE IP in trial implementation 2006 Connect-a-thon > 30 implementation tested. US CCHIT, Canada.
<b>Workflow</b>			
<b>Notification of Document Availability</b> Notifying a remote entity that one or more specific documents having been made available may be of interest.	Internet e-mail W3C DSG	-IHE NAV Integration Profile	Developed in 2005. IHE IP in trial implementation 2006 Connect-a-thon > 5 implementation tested.

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## EHRVA Roadmap Phase 2 Additions

Building on 2005-2006 Phase 1 Success

<b>Identification and Security</b>			
<b>Communication Service Use Case</b>	<b>Base Standard</b>	<b>Integration Profile (IP)</b>	<b>Availability and Implementation Readiness</b>
<b>Patient identifier cross-referencing and Patient demographics query.</b> Patient/consumer identification between Edge HIT systems and master patient indexes (MPI).	HL7 V3.0	-IHE PIX Integration Profile Extension -IHE PDQ Integration Profile Extension	IHE IP committed to development for ITI Tech Framework V3.0)  Leverages Canada & Netherlands
<b>Federation of XDS Domains</b>	HL7 V2.X-V3.0	Connecting for Health RLS- IHE XDS Federation	To be developed in 2006.
<b>Persistent Information Sharing</b>			
<b>Communication Service Use Case</b>	<b>Base Standard</b>	<b>Integration Profile (IP)</b>	<b>Availability and Implementation Readiness</b>
<b>Cross-Enterprise Document Interchange</b> Point to point interchange, either on physical storage media (CD or USB), or through document sets secured e-mail "push".	<i>Candidate Stds:</i> 9660 CD or USB. E-mail	IHE Cross-Enterprise Document Interchange (XDI)	To be developed in 2006.
<b>Sharing of Patient</b>	<i>Candidate Stds:</i>	-IHE XDS-MS	To be developed in

<b>Created Summaries.</b> Support consumers' ability to input and share their own health information with other healthcare entities.	HL7 CDA Rel 2, Care Record Summary HL7 V3 Meds, Allergies. ASTM CCR.	Integration Profile	2006.
<b>Sharing of Laboratory Reports.</b> Share laboratory results (sets of laboratory tests ordered and have been performed and validated). See Note	<i>Candidate Stds:</i> HL7 CDA Rel 2. HL7 Care Record Summary HL7 V3 Lab	-IHE XDS-Lab Report Integration Profile	To be developed in 2006.
<b>Sharing of Scanned Documents.</b> Sharing of scanned paper documents with other healthcare entities.	<i>Candidate Stds:</i> HL7 CDA Rel 2. PDF + TIFF	IHE XDS-Scan Docs	To be developed in 2006.
<b>Claim Attachments of Scanned Documents</b>	<i>Candidate Stds:</i> HL7 CDA Rel 2. PDF + TIFF	Claim Attachments NPRM	To be developed in 2006
<b>Dynamic Access</b>			
<b>Query Immunization Registry</b>	HL7 V2.5	Multiple Integration Profiling efforts non coordinated	Profiling incomplete and Connect-a-thon testing needed.
<b>Workflow &amp; Quality</b>			
<b>eRX</b>	<i>Candidate Stds:</i> NCPDP Script	NPRM	Profiling incomplete and Connect-a-thon testing needed.
<b>Ordering and real-time receipt of Lab Results</b> This Communication Service addresses the on-line ordering of laboratory work (on some sample) and the real-time sending of results (partial or complete). See Note.	<i>Candidate Stds:</i> HL7 V2.5	IHE Lab Scheduled Workflow convergence with ELINCS 2.x	To be developed in 2006.
<b>Bio surveillance Lab Notifications</b>	<i>Candidate Stds:</i> HL V2.5 Lab	CDC Impl. Guide	Available - Needs Connect-a-thon testing
<b>Bio Surveillance Info Entry</b>	<i>Candidate Stds:</i> HTPP+XHTML	IHE Request form for display	To be developed in 2006.
<b>Clinical Trial Capture</b>	<i>Candidate Stds:</i> HTPP+XHTML	IHE Request form for display	To be developed in 2006.

**Notes on access to laboratory results.**

1500 This Interoperability Roadmap distinguishes two communication services for accessing laboratory tests  
results. The first one is the service that enables a care provider to order lab tests (e.g., from the local  
EHR) and to receive the results as soon as released by the laboratory (e.g., from a lab information  
system). Results are received “real-time” by a connected receiver system (e.g., an EHR system). But  
1505 how does one access prior laboratory results that may have been requested by another provider? This is  
what the second service (sharing laboratory reports) addresses by allowing the sharing of previously  
ordered and released laboratory tests and results.

By distinguishing these two services, “lab orders/real-time results” and “sharing of prior laboratory  
results”, one clarifies two separate communication services that need to be addressed. In the  
Interoperability Roadmap, EHRVA takes advantage of this distinction to place high urgency (2006-2007)  
1510 on the second service. EHRVA recommends leveraging the HL7 CDA release 2 for sharing prior  
laboratory results in a structured form for several reasons:

- Persisted information has a long shelf life and introducing the HL7 V3 laboratory data structure  
(concept of clinical statement) with a CDA allows the persistence of more robust XML  
representations.
- 1515 • CDA is the choice for the Claim Attachments NPRM and leveraging what should become a  
common “container” is a simplification.
- The reuse of the Cross-enterprise Document Sharing (XDS) infrastructure for medical summaries,  
imaging information, etc., increases commonality and can serve to accelerate EHR adoption.
- 1520 • Many laboratory regulations around the world place “rendering” requirements on laboratory results  
(e.g. flagging abnormal values). These are easily addressed by the source of the laboratory  
report in the human rendering part of the HL7 CDA.
- Much energy needs to be devoted to increasing the robustness of LOINC to provide two-tier  
encoding of laboratory tests results to both meet laboratory requirements for precise tests  
identification and allow higher-level coding for rapid browsing of laboratory results by physicians.

1525 As a consequence, EHRVA promotes the upgrade of the myriad of HL7 V2.x lab interfaces to a  
consistent HL7 V2.5 (the first version with robust error reporting), sharing the same “extended LOINC”  
as the one defined above for laboratory reports in a CDA release 2. A migration to HL7 V3 messages  
is not practical until the disparate installed base of HL7 V2 lab interface has been rationalized, both in  
inpatient and reference labs. A significant part of the HL7 V2.5 profiling work has been started by IHE  
1530 with the Lab Scheduled Workflow Integration Profile and ELINCS. Harmonization of the two  
integration profiles will benefit both groups, which are engaged in discussions to merge their activities.  
We expect good progress in 2006 to deliver an harmonized EHR-to-lab integration profiles and a lab  
report sharing integration profile for January 2007 Connect-a-thon testing. CCHIT (EHR-to-lab) and  
now AHIC (Access to lab results) expect this work to proceed to meet their EHR certification  
1535 requirements and identified use cases.

## Bibliography and Resources

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<sup>a</sup> - ONCHIT EHRVA RFI Response

[www.himssehrva.org/docs/EHRVA\\_Response\\_to\\_ONCHIT\\_RFI-FINAL1.pdf](http://www.himssehrva.org/docs/EHRVA_Response_to_ONCHIT_RFI-FINAL1.pdf)

<sup>b</sup> - ONCHIT 13 Collaborative Organization RFI Response – Connecting for Health

[www.connectingforhealth.org](http://www.connectingforhealth.org)

<sup>c</sup> - IETF

<sup>d</sup> OASIS

<sup>e</sup> W3C

<sup>f</sup> HL7

<sup>g</sup> ASTM

<sup>h</sup> DICOM

<sup>i</sup> SNOMED

<sup>j</sup> LOINC

<sup>k</sup> ICD

<sup>l</sup> IEEE

<sup>m</sup> ISO

<sup>n</sup> NCPDP

<sup>o</sup> ANSI X12

<sup>p</sup> SAML