



Technical Review of Issues Related to Version 1 of the Public Health Information Network Functions and Specifications

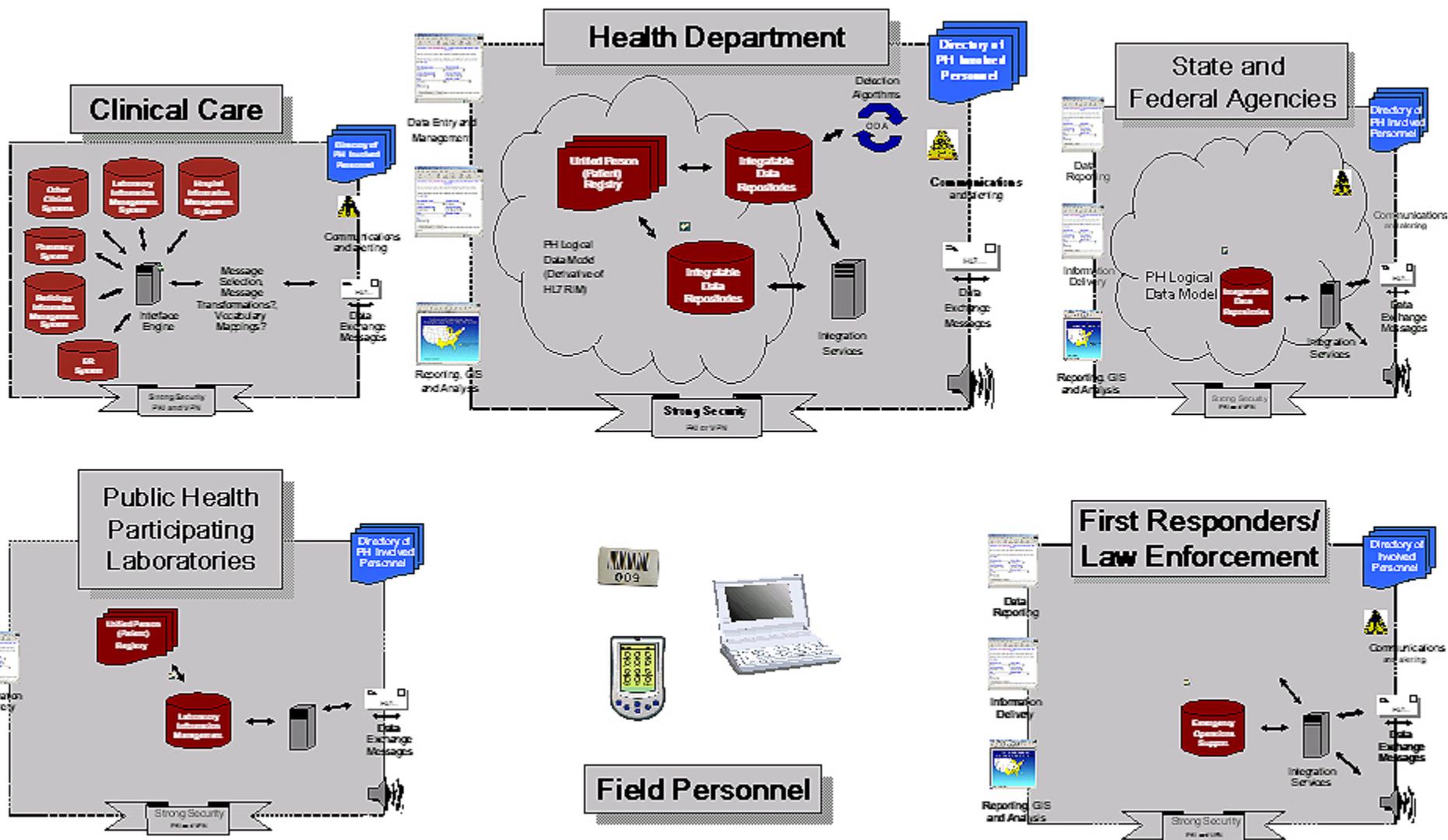
Centers for Disease Control & Prevention

13-15 May 2003

- The Public Health Information Network (PHIN) will:
 - **Implement and verify specific industry standards and to develop specifications internally to those standards:**
 - *to ensure comparable data, information exchange and interoperable systems; and*
 - *to facilitate the management, retrieval and delivery of public health information (i.e., reference, educational and communications).*

- In August 2002, the CIC approved these standards as Public Health Information Network Version 1 Functions and Specifications as well as approving an ongoing process for their review and evolution. In this process, several questions / concerns were raised. Therefore, the CIC also requested ***an initial technical evaluation of the PHIN functions and specifications in the context of the questions / concerns and requested that this review be completed as soon as possible*** to insure that public health organizations can wisely invest resources that are now available in the adoption of these standards.

Public Health Information Network



Source: CDC

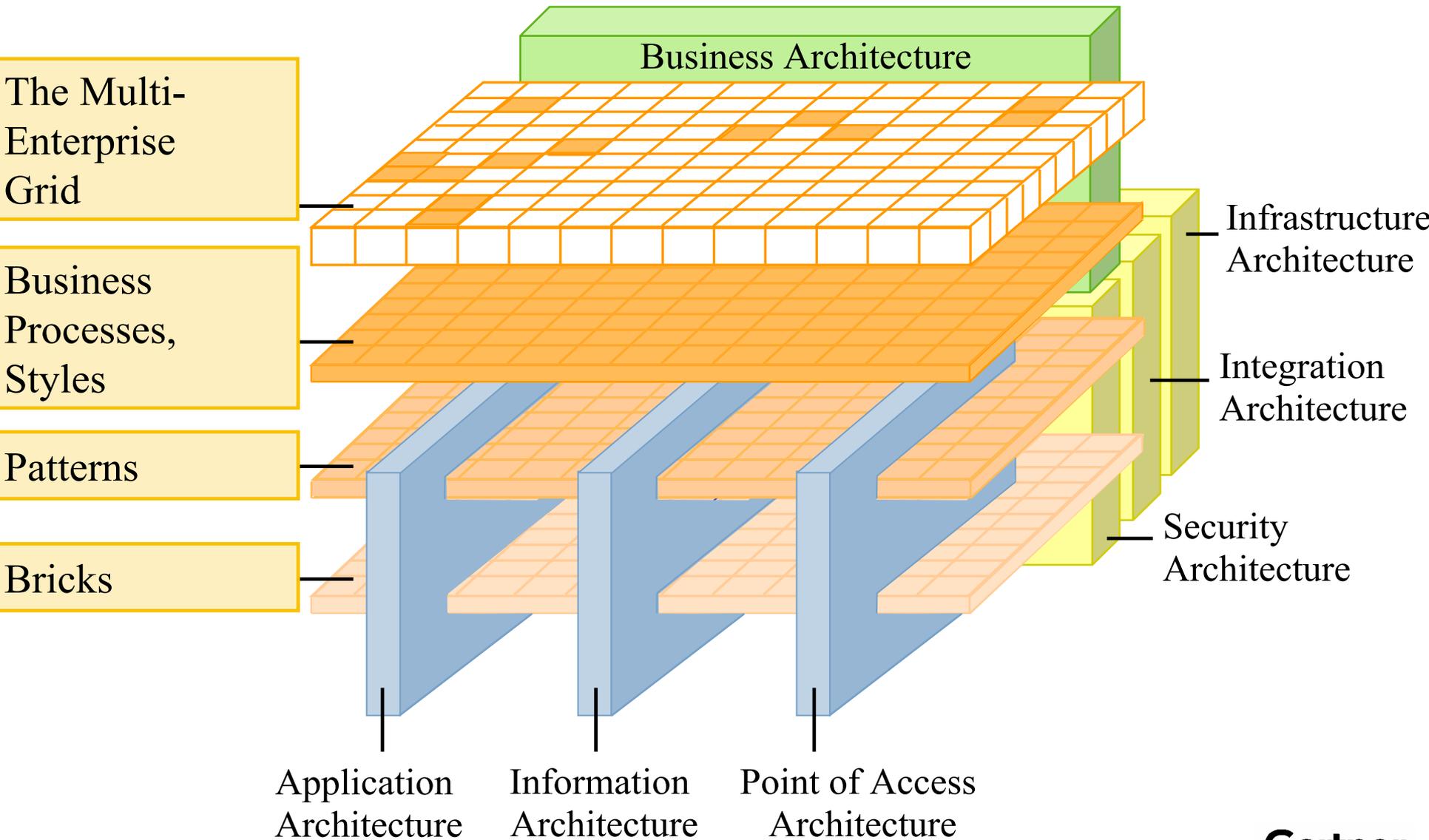
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consulting

PHIN Technical Review
13-15 May 2003

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Gartner's Architecture Framework



Questions Regarding the PHIN Version 1

From Engagement Tasking



- Is ebXML the right standard for the secure real-time, bi-directional exchange of public health messages across the Internet? Are there issues interfacing ebXML software with organizations that are using Microsoft software internally?
- Is LDAP/LDIF the right industry standard for interoperable directory services?
- What are the implications for application servers, regardless of physical platform, to run shared Java code? If the goal is to be able to have one version of an application run in any environment is there a way to have Microsoft application code be used in that context too?
- Do any of the functions and specifications mandate a particular product that might conflict with existing jurisdictional standards? Are there approaches to mitigating any conflicts, while still maintaining the functional objectives of the standards?
- Provide a realistic timeline for implementation of all the functions and specifications. (Consider some jurisdictions are starting from very basic IT functionality).
- Describe how participants can incrementally move toward compliance.
- Is there a sequence in which the functions and specifications should be implemented? How does the national mandate for bioterrorism preparedness get impacted by this sequence?
- How will those jurisdictions that are “behind” or “ahead” be supported while others “move further ahead”?
- Provide a clear definition of “compliance” which can provide a means by which our partners can assess (or self-evaluate) their systems for compliance with PHIN standards.
- Review for accuracy and provide clarifications if needed to the definitions in the glossary. Terms of particular interest include: LDAP, SMTP, Web Services, Multi-Tiered Architecture, ebXML, JavaScript, Microsoft Active Directory Services, and Firewall.

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■ Direct questions from both internal CDC groups and the Public Health partners:

- ❑ What are the Systems Integration Components to which the states should map?
- ❑ What are the processes to review and vet the PHIN standards and specifications moving forward?
- ❑ What are the overall Governance processes to support the PHIN program at CDC?
- ❑ What is the CDC Enterprise Architecture (EA)?
- ❑ What are the supporting processes for the CDC's EA?
- ❑ How can we simplify the PHIN document and make it more clear?
- ❑ How can we clean up the reference material to make it more clear?
- ❑ Aren't some of these IT capacities really public health functions?

■ Questions from the interviews:

- ❑ How do State & Local public health partners achieve interoperability with the PHIN?
- ❑ What do you have to do to write cross-platform services?
- ❑ Is it necessary to run Java modules to be compliant?
- ❑ Why is CDC advocating programming languages (i.e., Java) for an integration architecture?
- ❑ What standards are in use today and what are visionary?
- ❑ What is the “state of the market” for these proposed technologies?
- ❑ Should CDC be advocating ebXML or more widely used transport standards found in use in public health (e.g., VPN, encrypted email, secure FTP, etc.)?
- ❑ Should the CDC be developing its own version HL7 3.0 message segments (ahead of industry) or should they be advocating existing v2.x message segments and wait for industry to drive to the next release?

Findings Summary

From Interviews—General



- **The vision and mission of the PHIN is widely accepted by the public health (PH) partners as correct...everyone buys into the concept of the PHIN.**
- **The PH partners feel that the PHIN will help establish new standards and guidelines for each of them to use in building and integrating their systems and data. The PHIN is a foundational “road map” for systems integration.**
- **Not all of the most current “mission, vision, program charter, etc.” material on the PHIN is readily available on the Web.**
- **The PH partners see PHIN as the continuing evolution of NEDSS activities—with an emphasis on systems integration.**
- **The PHIN vision must continue to broaden beyond the structured data obtained from surveillance systems and labs to include syndromic data from clinics, ERs, Doctor’s offices, pharmacies, etc. that may not be available in a structured form.**
- **The PHIN has not adequately addressed the details of how to capture early warning or emergency response data that could be gathered from a variety of less structured sources and systems—the “access architecture” must continue to be broadened to address multiple means of data entry when a PHIN compliant surveillance system, process or web based interface is not available.**

Findings Summary

From Interviews—General



- **Controlled medical vocabularies (CMVs) are evolutionary in nature. The PHIN needs to accommodate reporting on data where codes have not been established.**
- **There is a need for increased staffing and governance processes at the CDC to support the continued development and review of these standards—to include input from all partners. These items need to be developed for long term support of the PHIN and the PH partners must participate to help achieve this.**
- **There are still some PH communities (outside of CDC and PH partner control, but part of the overall “PHIN”) not using HL7 messaging formats, even in the advent of organizations such as the National Committee on Health and Vital Statistics (NCHVS), the Consolidated Health Informatics (CHI) initiative and HIPAA regulations advocating its use.**
 - HHS Secretary Thompson’s announcement on 23 March 03 specifically called for all federal agencies **to adopt Health Level 7 messaging standards**, certain National Council on Prescription Drug Programs standards, the Institute of Electrical and Electronics Engineers 1073 series of standards, the Digital Imaging Communications in Medicine standards and **the laboratory Logical Observation Identifier Name Codes (LOINC)**.

Findings Summary

From Interviews—Internal to CDC



- **Currently, CDC software development (for both distribution to PH partners and internal use) is on a variety of platforms representing different architectural “design patterns”. There is concern that the PHIN/NEDSS standards are going to become a “one size fits all” development solution for all business needs.**
- **For the internal shops that are developing software for release to PH partners in an J2EE environment, there is little to no impact adopting these standards.**
- **For internal shops developing software for release to PH partners in .NET, DCOM or other environments, there is a huge impact (time, resources and money) to develop in the J2EE “design pattern” because of investments already made in other systems and skills.**
- **There is no consistent application of SEI CMM* like processes at CDC for developing systems. Applications Development may not be a core “business” of the CDC, but a tremendous amount of resources have been invested in it. Several examples encountered by Gartner at the CDC include multi-million dollar per year projects with a wide variety of development process, tools and skill.**
- **There is a serious lack of architectural management across the CDC—each center and each vendor employed brings in “their own architecture”.**

*Software Engineering Institute Capability Maturity Model

Findings Summary

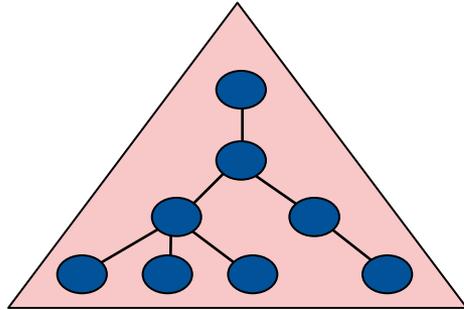
From Interviews—External to CDC



- PH departments' biggest concerns are for the mandates for HIPAA compliance and the threats / implications of bioterrorism.
- States see PHIN as defining an integration architecture, not an application architecture (i.e., emphasis on data standards, formats and communication).
- Most states are supporting a variety of “low tech” HW/SW platforms today (applications and networks) to communicate information from local PH entities and clinical partners to state PH departments.
- Most PH departments are using some form of directory services (not necessarily LDAP). Very little LDAP capability is in place today.
- Very little HL7 capability is in place today. Mostly this is used with large “trading partners” such as national labs.
- States have developed software using a variety of development environments including .NET and Java; additionally—Visual Basic, FoxPro, etc.
- There has been some reaction to the requirement to provide the ability to run “shared Java code” on partner owned platforms (no matter what they are).
- There were several requests for the NEDSS Base System roll out to individual states—there is a real desire for this product in the field.
- State PH partners feel that the PHIN should be focused primarily on data, data formats, data elements—and less on future technologies such as ebXML.
- Implementing HL7 compatible software within their Laboratory Information Management Systems (LIMS) or with commercial products has been expensive for most labs—they would like to see CDC develop a LIMS or put money into a commercial product to give to the states that meets the PHIN standards.
- States want more communication on the PHIN functions/topics in order to build out this proposed infrastructure. For example, how is LDAP truly to be implemented and securely used for the national “Directory of Public Health”?

- **The ebXML Message Service (ebMS) specification was originally developed by the ebXML initiative of UN CEFAC and is now maintained by OASIS. ebMS provides Confidentiality, Authentication, Integrity of the Message, and Non-repudiation (CAIN) functionality for payloads in any syntax. The only similar standard is a draft of EDIINT Applicability Statement 2 (AS2). EDIINT handles EDI explicitly, but only handles HL7 in an “other” category. Additionally, the Web Services community is developing WS-Reliability specifications which may have similar capability.**
 - ❑ Both ebMS and EDIINT AS2 have had successful interoperability testing, involving a limited number of software agents running in the Windows and other operating systems.
 - ❑ Neither has progressed to the point where two arbitrarily chosen compliant program agents would interoperate without tweaking.
 - ❑ Both protocols have been used successfully by channel masters that either (a) offer downloadable communications software to trading partners, or (b) offer a certification program to support trading partners in tweaking their software for interoperability.
 - ❑ ebMS is based on a variation of SOAP which makes it closer to Web Services
 - ❑ The OASIS group working on ebMS has stronger ties with the Web Services community and is more likely to converge with WS-Reliability as it evolves.
 - ❑ Neither protocol is ideal, but each has been proven viable in controlled environments.
 - ❑ **However, the evolutionary path of ebMS allows for better alignment with the widely proliferated Web Services initiatives.**

- **A: Yes - ebXML is an appropriate protocol for the PHIN to target for adoption.**



A directory is a special type of database optimized for high-performance read operations and scalability.

■ LDAP is the appropriate for use within the PHIN.

- ❑ LDAP is a directory access methodology that can be used to access conventional directories (such as Microsoft Active Directory, Novell eDirectory and Sun ONE Directory Server), as well as relational databases and other data structures. LDAP describes the access methodology but not the underlying store. **In most respects, LDAP is to directories what Open Database Connectivity (ODBC) is to databases.**
- ❑ LDAP directories are highly scalable. They can easily support millions of users and can be implemented in a centralized or decentralized architecture.
- ❑ LDAP directories are streamlined for reading. In most cases, an LDAP directory will outperform a database when it comes to heavy read loads.
- ❑ LDAP directories are supported by third-party vendors. This makes it easier to bring in a third-party application or authentication module and integrate it into your infrastructure.
- ❑ LDAP is a simple standard for programmers to implement. Using LDAP insulates programmers from platform and vendor tie-ins.

- **Q: What are the implications for application servers, regardless of physical platform, to run shared Java code? If the goal is to be able to have one version of an application run in any environment is there a way to have Microsoft application code be used in that context too?**
 - Running shared Java code, regardless of physical platform for the application servers, is an unnecessary burden to place on the State and Local partners. The CDC should mandate internal coding platforms and standards as part of its enterprise architecture design pattern for software being released to its PH partners.
 - EA design patterns for PHIN can be provided as guidance to the PH partners, but the PHIN will focus on data, data structure and communication standards for its partners.
- **A: The key here is “policy” versus “guidance”. CDC should mandate use of these application development standards as policy for internal CDC development and provide them as guidance to partners.**

- **Q: Do any of the functions and specifications mandate a particular product that might conflict with existing jurisdictional standards? Are there approaches to mitigating any conflicts, while still maintaining the functional objectives of the standards?**
 - ❑ This question is really only answered by a complete state by state assessment (not part of this engagement).
 - ❑ Anecdotally, through the interview process conducted for this review, these functions don't appear to conflict with any known jurisdictional standards.
 - ❑ An additional insight to this question though is to what extent is this question relevant if the focus of PHIN will be on systems integration standards (and not on specific implementation approaches as discussed on the previous slide)?
- **A: The PHIN standards should focus on systems integration components (data exchange, formats and secure transmission) for state partners as recommended in this report.**

■ **A: A realistic implementation guideline for PHIN would include the following:**

- ❑ Gartner makes no assumption of a particular programming language or development environment mandate for external CDC application development, but assumes CDC will continue to publish “guidance” by way of PHIN standards and specifications documents.
- ❑ Gartner assumes that the CDC will promote not only the PHIN/NEDSS standards for application development, but will allow for a transitional elements within that architecture. The transitional components are for those architectural elements that are not widely available in the commercial market or are too burdensome for the PH partners to implement throughout the partner “supply chain” at the present time. Further discussion within industry best practices section of detailed report...
 - Note: CDC and partners should perform a quick “technology survey” with the States to understand the current baseline of architectural components and standards in use and to determine what compliant components may be leveraged by the PHIN
- ❑ If the CDC mandates use of the PHIN/NEDSS standards for internal CDC application development, AD time will increase for those shops currently on different architectural platforms.
- ❑ Generally speaking, a well-resourced AD shop can develop basic application functions / capabilities using a PHIN compliant data model, CMVs, directory services, messaging formats, transport & security standards, etc. (through either internal staff or contractors who have these skills) within 9-12 months - longer for those shops that will need training on these components.
- ❑ Any major systems re-architecting (by internal CDC, State, or Local partners) will depend on the size and scope of the required changes. For example, a system requiring a messaging only addition should be able to comply within 3-6 months. A large system that does not currently use a compatible data model or CMVs may take as much as 18-24 months to re-architect.
- ❑ The CDC and its PH Partners need a real commitment to do this!

■ **A: The incremental steps towards compliance would include adoption of a transitional architecture and supporting processes by CDC (see industry best practice section):**

- ❑ With the adoption of transitional architecture elements (i.e., those items that are widely used in industry but do not represent the “target architecture”), the CDC and its PH partners must ensure that the transitional elements guarantee similar features and security (e.g., guaranteed delivery of messages and maintaining the goal of a “live” network) and that there is a plan to migrate to the target architecture within a reasonable timeframe.
- ❑ The CDC can promote the adoption of the target architecture by buying or building compliant components such as an HL7 compatible LIMS and messaging systems (available from CDC today as prototypes—such as the PH Messaging System) and providing this to its PH partners. Additionally, CDC could provide PHIN compliant code to COTS vendors to include in their products.
- ❑ To move towards compliance, if at all possible, these activities should be undertaken concurrently.
- ❑ If resources are constrained, application development teams should focus first on the data, data structure, data model and the use of CMVs in their applications (i.e., create data that can be easily aggregated at the national level using the XML schema).
- ❑ The next series of activities should focus on the development the messaging formats, transport & security standards to easily and securely share this data with its PH partners and CDC.
- ❑ Then, focus on directory services that will allow authorized and controlled access to provider information should be developed and made available to the PHIN.
- ❑ Lastly, anything that can be provided by CDC (e.g., compliant software modules, tools for messaging, etc. built on PHIN standards) should be made available to the states and their partners in an effort to develop a nationally compliant PHIN infrastructure.

■ **A: For jurisdictions moving “ahead” or “behind”:**

- ❑ No architecture ever has everyone “on the same page”.
- ❑ The “target” systems integration architecture (i.e., PHIN) must provide standards, design patterns and formats that application developers use to integrate their applications into the PHIN.
- ❑ For particular components, CDC should provide the tools and modules to help promote standards and build out key PHIN infrastructure components (e.g., HL7 v3.0 structures, ebXML messaging, etc.).
- ❑ PHIN should allow for multiple solutions for those components that are more technically challenging or immature in the market - with the goal of annual review and updating of these solutions through the EA Core Processes (e.g., HL7 v3.0, ebXML). However, the goal of a “live” network must be maintained.
- ❑ Where jurisdictions are ahead they are less able to leverage what CDC can provide, but they must be seen as a valuable input to CDC’s contribution (potentially the new “target” architecture). See Industry Best Practices Section for EA Core Processes - Exception Handling Process.
- ❑ For those that are behind, CDC should provide tools that allow them to work at their level of technical competence in a secure and reliable manner and strive to maintain the goal of the “live” network.
 - For example: information transfer could function like a clearing house (i.e., the state PH department is the clearing house for the state and its partners) :
 - » larger organizations and the state PH department employ the PHIN standards for communication;
 - » mid-size organizations or larger local jurisdictions use electronic, but alternative transfer standards (e.g., secure FTP, encrypted email, etc.) - guaranteed to delivery standards; and
 - » small organizations, small jurisdictions accomplish data entry via web to State or rely on alternative processing until this capability is available.

- **Review for accuracy and provide clarifications if needed to the definitions in the glossary. Terms of particular interest include: LDAP, SMTP, Web Services, Multi-Tiered Architecture, ebXML, JavaScript, Microsoft Active Directory Services, and Firewall.**
 - Gartner has reviewed the glossary and updated it as appropriate (39 pages)—provided under separate cover.

- **Provide a clear definition of “compliance” which can provide a means by which our partners can assess (or self-evaluate) their systems for compliance with PHIN standards.**
 - A PHIN Compatible System will meet all the standards provided within the specifications. Gradations of compatible may need to be considered during evaluation.
 - Compliance Testing will evaluate specific elements of systems to function within the PHIN specifications and will focus on applications that can create and send data in the correct format through the agreed to business rules that supports the “live” network in a secure, reliable, near real-time, and resilient manner.

■ It appears that the following elements are missing or not fully developed in version 1 of the PHIN:

- ❑ The architecture needs to be more specific on the “analytics” component. How is data to be analyzed at the CDC? Is data stored in a data warehouse? data marts? How do states access their information? How do other constituents access this data and use analysis and visualization tools?
- ❑ The architecture needs to describe any “collaboration” components such as message boards, white board capabilities, etc.
- ❑ Continue to develop the “PH Information Dissemination and Alerting” function through a look at the “enterprise nervous system” technologies that are immersing.
- ❑ The PHIN needs to fully develop the business continuity planning / disaster recovery components of this architecture. How resilient is the architecture in case of failures of individual data bases, network segments, etc.? Should key states and/or information sources have alternative communication paths to CDC other than the internet?
- ❑ What are the databases of record that make up the PHIN? Who manages them?
- ❑ How are non-structured data (e.g., some of the syndromic data) to be viewed? searched?
- ❑ The security standards (beyond message transport) need to address items like overall information assurance program, denial of service attacks, cyber terrorism, etc.

- **Fully Develop EA, EA Governance structure and processes:**
 - ❑ Emphasize Systems Integration components to PH partners—data, data formats, CMVs, messaging, secure PH directory, secure transport—not development languages/platforms.
 - ❑ Establish PHIN v1 as the target architecture, establish Standards Review and Exception Handling processes for PH partners (perform a quick technology survey and component review to support this effort)
 - ❑ Make accommodations for “transitional” architectures to reflect state of the market for certain technologies and PH partner technical competence. Ensure that there is a plan and a timeframe to migrate to the target architecture.
 - ❑ Structure PHIN documentation to better communicate its systems integration mission externally and AD standards internally
 - ❑ Continue to provide detailed specifics on the technical standards to PH partners and continue to provide support from CDC technical resources to enable them.
 - ❑ Address the architecture “gaps” identified in this report.
- **Develop and release compliant modules for PHIN, make available to PH partners.**
- **More fully develop the implementation guidelines, development tool kits and AD maturity processes—policy for internal CDC and as guidance for PH partners.**
- **Develop PHIN compliance capability through self accreditation process, IV&V, test data sets and materials.**
- **Develop a communication strategy / marketing campaign to ensure that the right documents get to the right people.**
- **Clearly identify databases of record and establish appropriate data management practices.**
- **Develop BCP/DR strategy and test.**

■ How to make this work:

- ❑ Attach the PHIN standards to the money (i.e., cooperative agreements) like was done with the bioterrorism agreement.
- ❑ The individual states will need to develop the required skills for each of these technologies - continue technical support from CDC is welcome by way of guidance and tools
- ❑ Support and funding for developed applications from internal state leadership is critical
- ❑ Consider outsourcing options to get states up and running on newer technologies, then transition application support to state teams with appropriate knowledge transfer
- ❑ Security will continue to be difficult because it is required at all levels of state PH infrastructure and its not there now; CDC/PHIN should provide “transitional” guidance for these situations and independent verification & validation (IV&V) services to assist the states with security compliance.
- ❑ Overcome the predisposition to build when buy is an option within PH community (communication, evaluations at CDC, etc.)
- ❑ CDC to release several workable components, built to PHIN specs, to show the PH community how to interface, build basic components, etc. In particular - HL7 v3.0 and ebXML.
- ❑ Emphasize the benefits to the PH partners in the states:
 - The feedback on the data that is sent to CDC, analyzed and then available for review
 - The potential to use clinical data for event detection
 - Analysis and visualization of data
 - Improved data collection and reporting process, timeliness and accuracy.

■ Conclusions:

- ❑ An independent review of the PHIN Version 1 has been completed
- ❑ PH partners universally agree to the vision and overall direction of the PHIN
- ❑ The PHIN standards and specifications are a strong start and are appropriate for use in PH, as annotated in this report
- ❑ Success of the PHIN relies on both CDC and its PH partners—all must commit to this initiative in order for it to succeed
- ❑ As the PHIN evolves, there are several gaps to be filled in the overall architecture
- ❑ There are several enterprise architecture best practices to be employed that will help the CDC and its partners evolve the PHIN.

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