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Summer Institute / HIT Series

Health Information Exchange

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2 hrs / ~90 slides

Overview

- Introduction
- History of HIE
  - *CHIN, CHMIS, SBCCDE, EDI, ONC, NeHC, SI.Framework, HISPC, NHII/NwHIN, HIO*
- HIE Architecture
- HIE Services
- HIE Sustainability
  - *Federal (HITECH) Impact*
  - *States Impact*
- HIE Examples
  - *Indiana HIE*
  - *CRISP*
- HIE and Population Health IT
- HIE Future
- Summary

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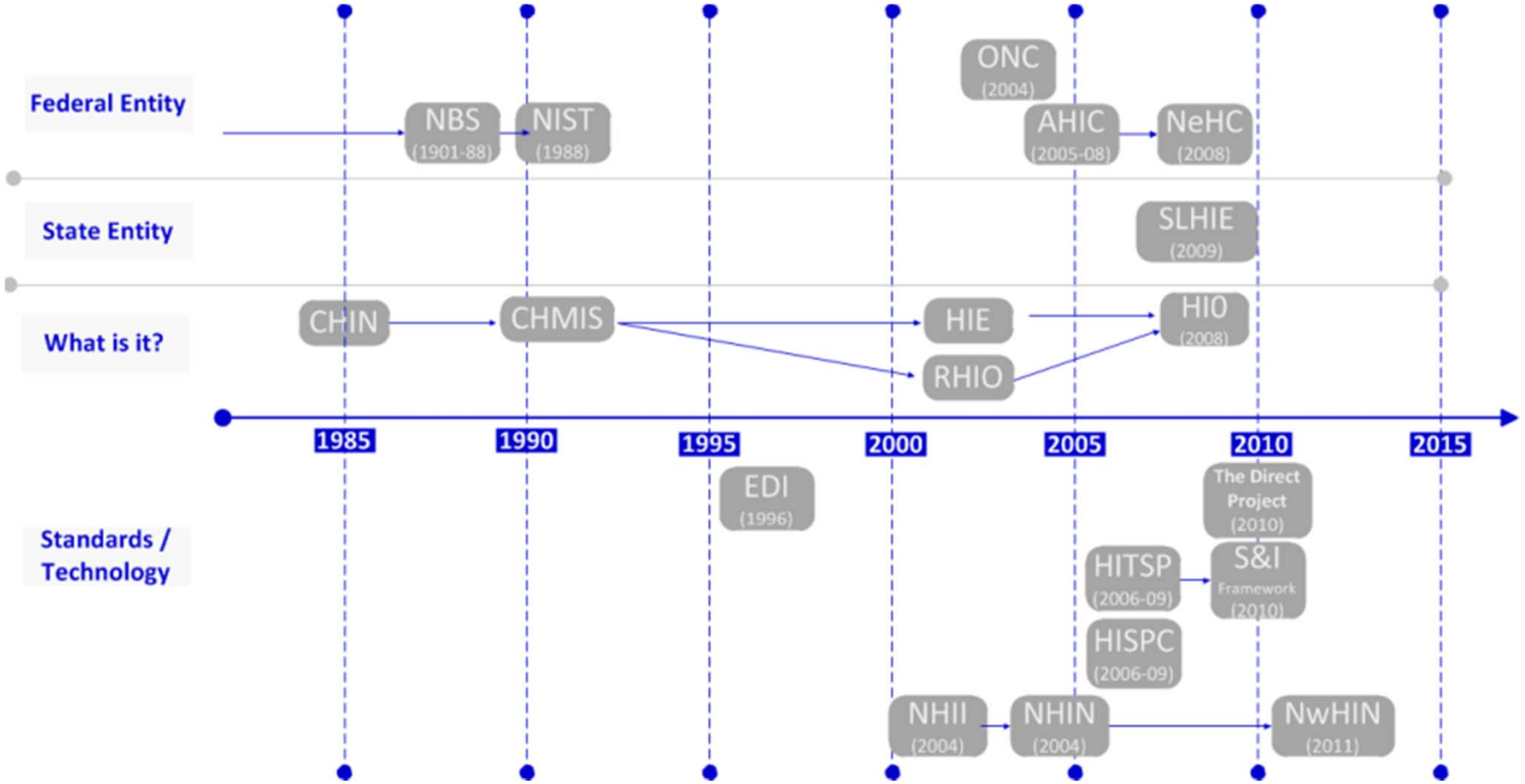
History of HIE

History of HIEs



History of HIEs → Community Health Information Networks (CHIN)

- A community health information network (CHIN) is an organizational and technical entity designed and operated to facilitate the electronic data interchange and integration of various types of health care information for the benefit of those organizations and health care professionals that participate in the network. (~1985)

- Most CHINs disappeared but two of CHINs did survive over time:
  - Wisconsin Health Information Network (www.wishin.org)
  - Utah Health Information Network (www.uhin.org)

- Main challenge for CHIN:
  - "*The real killer why CHINs did not get any further than they did is that very few of them paid attention to sustainability*" (Overhage)
  - CHINs received tens of millions of dollars from foundations and vendors, but lacked a business plan to become self-sufficient after they burned through their initial wave of funding and community enthusiasm for their projects.

History of HIEs → Community Health Management Info. Networks (CHMIN)

- Create both a data network and a data repository to measure cost and quality from competing providers in a given community. (~1991)
- Seven states were funded: MN, IA, OH, VT, WA, NY, TN
- MN has the most successful CHMIS: Legislation partially funded the Minnesota Health Data Institute as a partnership between the Commissioner of Health and a 20-member Board (with stakeholders). Law also asked for standard electronic transmissions, unique patient identifiers and privacy protections. MedNet was built in 1995 for transmitting claims, eligibility and enrollment.
- Main challenge for CHMIS:
  - VT → Difficulty arose in securing long-term cooperation.
  - TN → It lacked a broad community base of stakeholders.
  - IA → The cost of the data repository was problematic.
  - OH → Independent community networks limited revenue to CHMIS.
- General issues with CHIMS: (1) separate network idea instead of using current networks; (2) Internet technology was just becoming available; (3) no incremental steps to generate short-term outcomes; (4) too many stakeholders were involved.

History of HIE → Santa Barbara County Care Data Exchange (SBCCDE)

- A secure regional network for electronically sharing healthcare data among doctors, healthcare facilities and patients. Shared patient information included test results and reports. (~1998-2006)
- California HealthCare Foundation funded it ($10M).
- CareScience was the vendor (CEO David Brailer)
- Main challenge for SBCCDE:
  - **Funding**: Participating healthcare entities did not contribute.
  - **Vendors**: Software development delayed.
  - **Community**: No demand from local community.
  - **Governance**: Neither physicians nor hospital administrators had control or provided input.
  - **Legal Issues**: No consensus from lawyers across participating entities.
  - **Data Privacy**: Participating entities could not find consensus.
    - More at: *Fried BM. What killed the Santa Barbara County Care Data Exchange? iHealthbeat. March 14, 2007*.

History of HIE → Electronic Data Interchange (EDI)

- Without a standards-based approach to data sharing between organizations, the on-going evolution of exchanging data might have remained a difficult obstacle for the entire healthcare industry.
- EDI was developed by National Institute of Standards and Technology (NIST) (~1996)
- In its initial stage, EDI primarily focused on financial and administrative data. As automation of clinical information has grown since 1996, a number of bodies have continued to work on EDI for all types of healthcare data:
  - ANSI
  - HL7
  - CAQH
  - CORE
  - Others to evolve

History of HIE → Office of the National Coordinator for HIT (ONC)

- ONC, a principal federal entity with the Department of Health & Human Services, is charged with coordination of nationwide efforts to implement and use the most advanced health information technology and the electronic exchange of health information. (~2004 / 2009 legislated)

- Mission:
  - Promote development of a nationwide Health IT infrastructure for electronic use and exchange of information
  - Provide leadership in the development, recognition, and implementation of standards / certification of Health IT products
  - Health IT policy coordination
  - Strategic planning for Health IT adoption and health information exchange
  - Establish governance for the Nationwide Health Information Network (NwHIN)
  - More: http://healthit.hhs.gov

History of HIE → ONC *(cont.)*

- ONC National Coordinators:
  - David J. Brailer, MD PhD (May 2004)
  - Robert M. Kolodner, MD (Sep 2006)
  - David Blumenthal, MD (Mar 2009)
  - Farzad Mostashari, MD MSc (Apr 2011)
  - Karen DeSalvo, MD MPH MSc (Jan 2014)


D. Brailer

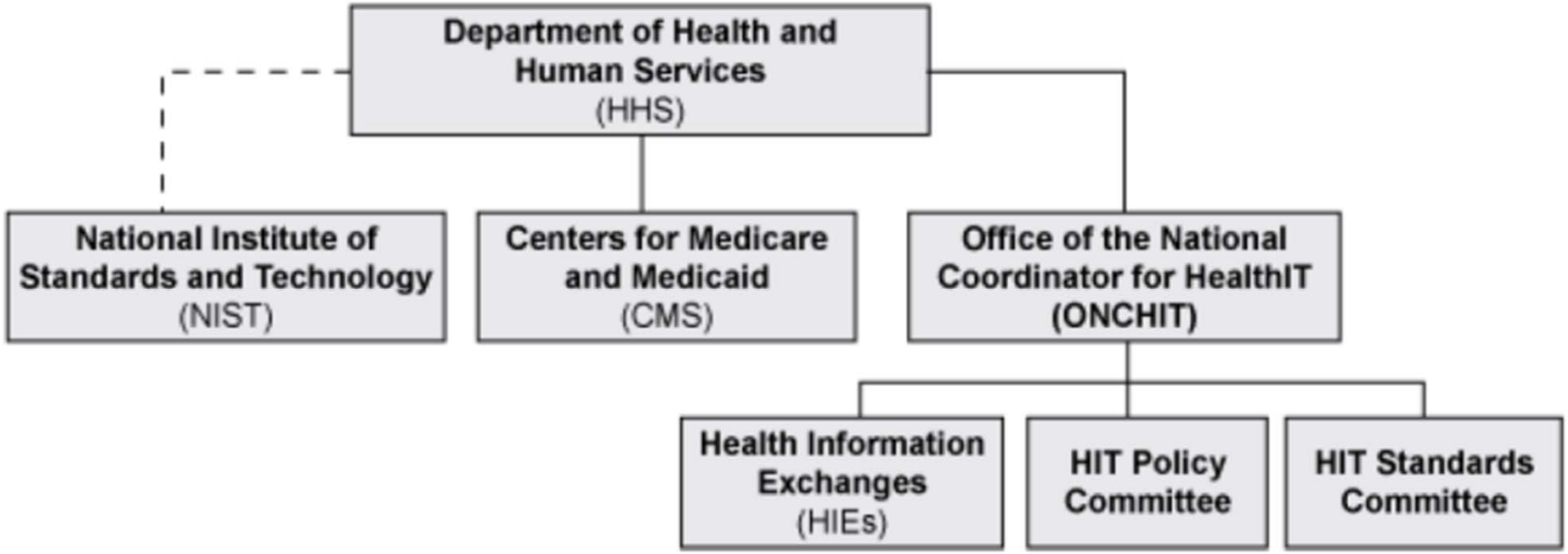

R. Kolodner


D. Blumenthal


F. Mostashari

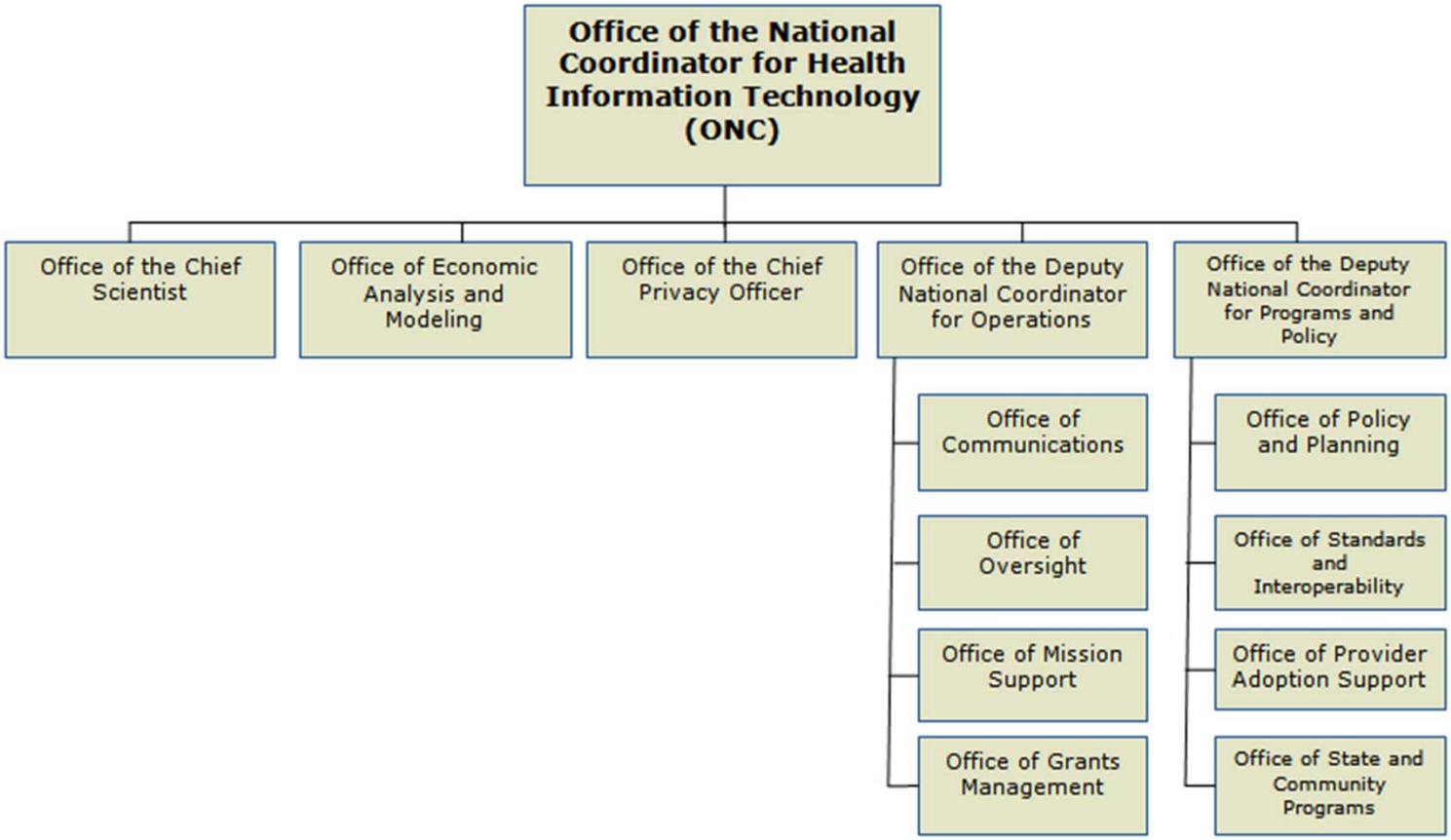

K. DeSalvo

History of HIE → ONC *(cont.)*



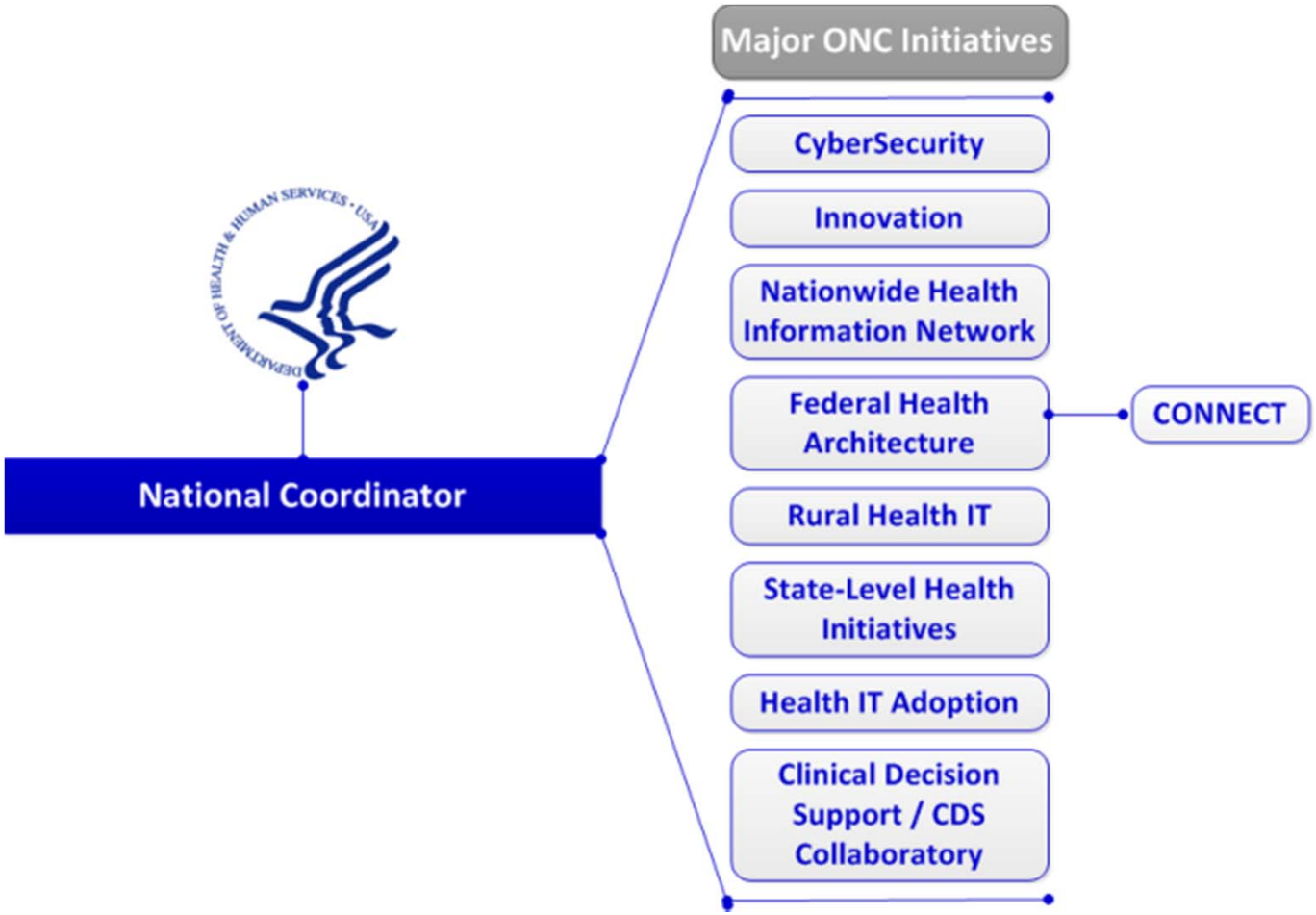
ONC relationship with DHHS

History of HIE → ONC *(cont.)*



ONC Organizational Structure

History of HIE → ONC *(cont.)*



Eight Major ONC Initiatives

History of HIE → National eHealth Collaborative (NeHC)

- A public-private partnership that enables secure and interoperable nationwide health information exchange to advance health and improve healthcare. (~2012)
- Mission:
  - Address barriers that might thwart the nation's progress toward interoperability.
  - Work to educate, connect and encourage healthcare stakeholders who are critical to the successful deployment of health information technology and health information exchange nationwide.
- NeHC University is a web-based education program designed to provide stakeholders with timely and relevant information on health information technology and health information exchange in the US.
- More: www.nationalehealth.org

…HIE → The Standards & Interoperability Framework (S&I Framework)

- The Standards and Interoperability (S&I) Framework is a set of integrated functions, processes, and tools being guided by the healthcare and technology industry to achieve harmonized interoperability for healthcare information exchange. (~2012)
- Mission/Goals:
  - Linkage of objectives, challenges, use cases, requirements, and standards across the solution development lifecycle
  - Repeatable mechanisms for harmonization and integration of existing standards, as well as identification of new standards
  - Development of tools that enable consistent, robust, and testable solutions *(e.g., test suite to validate an implementation against a specification)*
  - Integration of multiple Standard Development Organizations (SDOs) with different expertise across the solution development lifecycle
  - Leveraging of federal guidance and best practices.
- More: www.siframework.org

...HIE > Health Information Security and Privacy Collaboration (HISPC)

- Address the privacy and security challenges presented by electronic health information exchange through multi-state collaboration. Harmonize state privacy law. (award ~2006 – 2009 then membership).
- Two tools were developed:

- **Comparative Analysis Matrix (CAM)**: collection of almost 150 subject matter areas typically addressed by state law that involve or may impact the use and disclosure of health information.
- **Assessment Tool**:
  - assist stakeholders to identify and obtain consensus on priority recommendations for legislation
  - enable a state to identify and analyze relevant state statutes and establish a priority order for potential statute modernization efforts
  - allow states to identify non-legislative solutions to address identified issues.

History of HIE → National Health Information Infrastructure (NHII)

- A healthcare standardization initiative for the development of an interoperable health information technology system. (~2004)
- Mission: Build an interoperable system of clinical, public health and health information technology + encourage public-private partnership with a Federal leadership role.
- The NHII evolved into the Nationwide Health Information Network (NwHIN):

NHII (2004) → NHIN (2010) → NwHIN (2011)

- NHII Projects:
  - Phase I (May 2007): build prototype and show determination of need → Accenture, CSC, IBM, Northrup Grumman
  - Phase II (Oct 2007): specification of factory → 9HIEs (TN, DL, IN, CA, NM, VA, Y, NC, WV)
  - Phase III (2011): production phase → ~35 participants

History of HIE → Nationwide Health Information Network (NwHIN)

- A set of standards, services and policies that enable secure health information exchange over the Internet. (~current)
- Mission: Facilitate exchange of healthcare information being developed under governance of ONC.
- Stakeholders:
  - Care delivery organizations (CDOs) using EHRs
  - Consumer organizations operating personal health records (PHRs)
  - HIEs with multi-stakeholder entities
  - Specialized participants (data for secondary uses)
- Exchange participants: DoD, VA, SSA, CDC, MedVirginia, KP, Regenstrief Institute, HealthBridge, NC-HIE, Inland NWHS
- Granted funding for multiple Beacon Communities

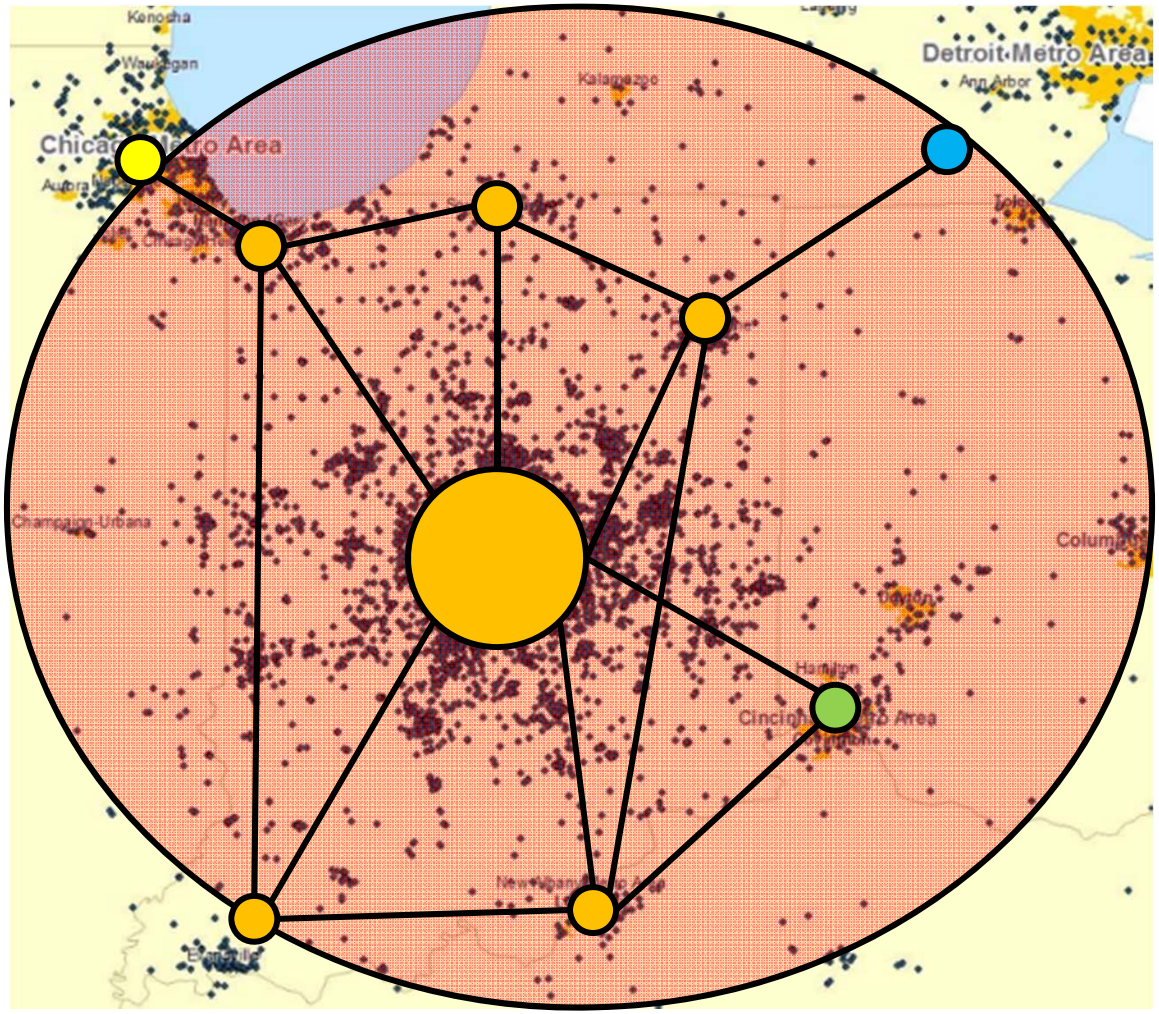
History of HIE → Health Information Organization (HIO)

- HIE (verb): The electronic movement of health-related information among disparate organizations according to nationally recognized standards in an authorized and secure manner.
- HIO (noun): An organization that oversees and governs the exchange activities of health-related information among independent stakeholders and disparate organizations according to nationally recognized standards in an authorized and secure manner.
- An HIO can be described by many acronyms, including:
  - State Level Health Information Exchange (SLHIE)
  - Regional Health Information Exchange (RHIO)
  - Regional Health Information Network (RHIN)
  - Health Information Exchange Networks (HIE[N])
  - Others: Integrated Delivery Systems (IDNs); Physician practices HIEs; Payer-led HIEs; and, Disease-specific HIEs.

History of HIE > HIO *(cont.)*

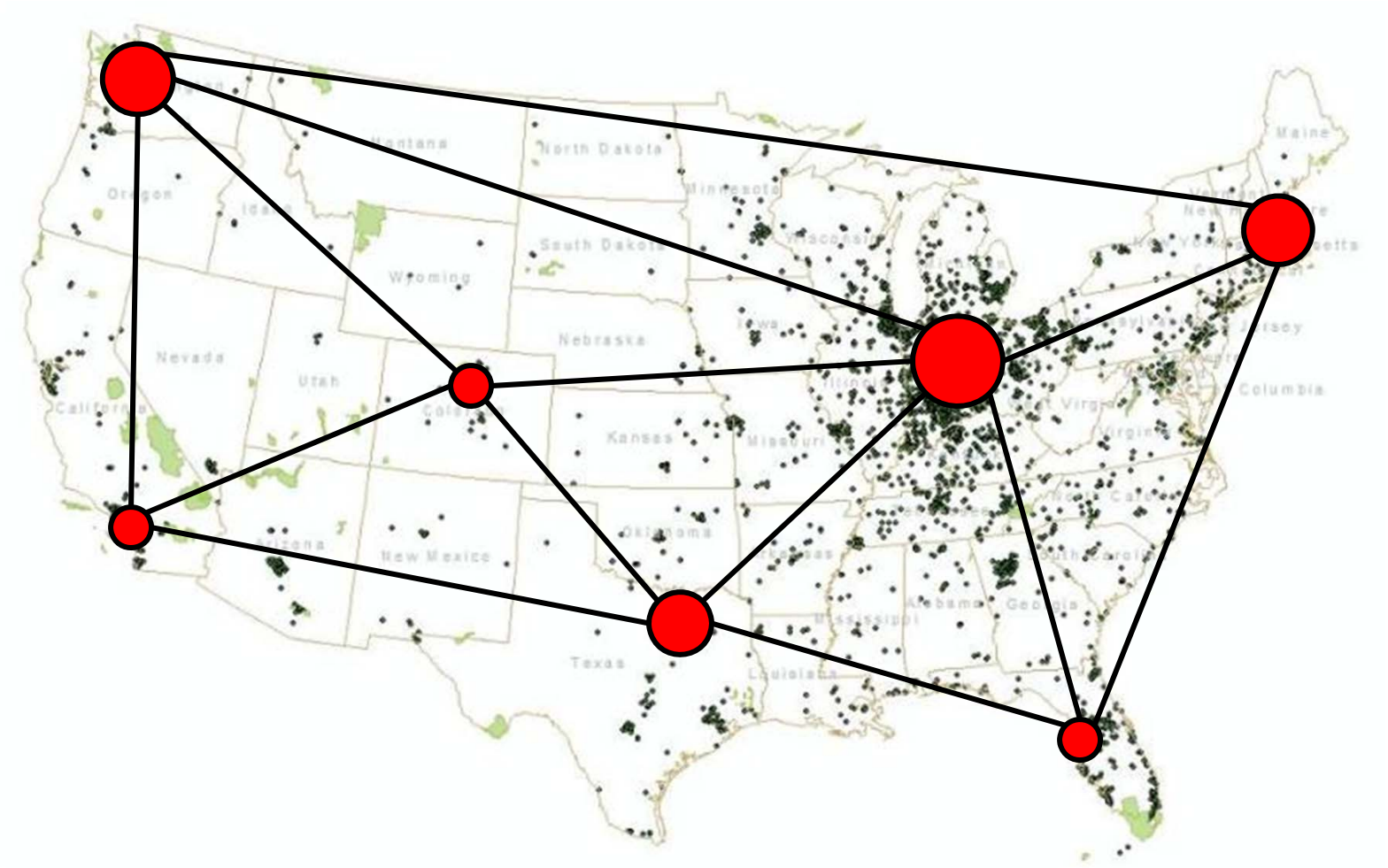
Health Information Organizations

History of HIE > HIO *(cont.)*



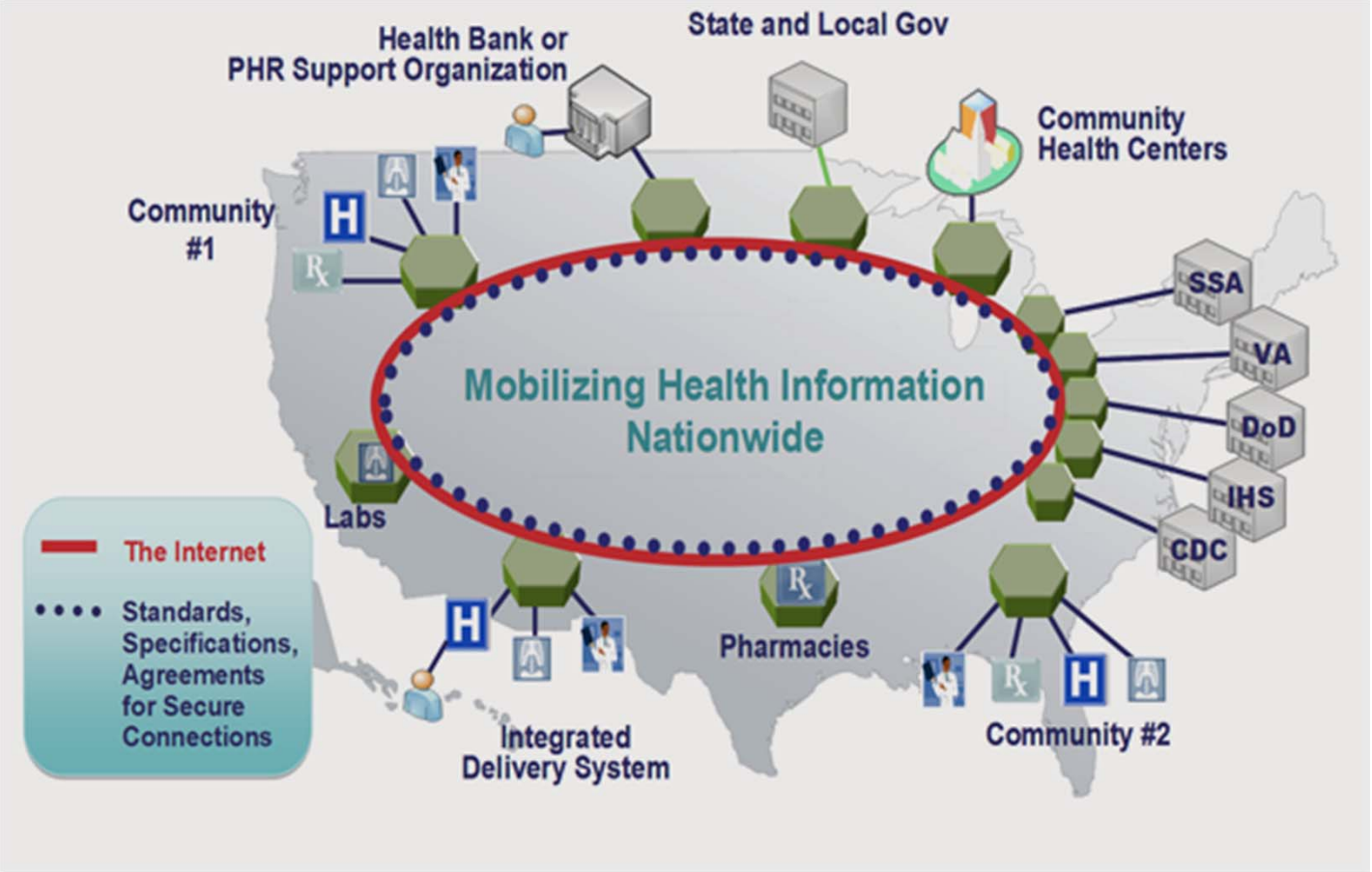
Health Information Organizations

History of HIE > HIO *(cont.)*



Nationwide Health Information Network (NwHIN)

History of HIE → HIO to NwHIN



Nationwide Health Information Network (NwHIN)

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HIE Architecture

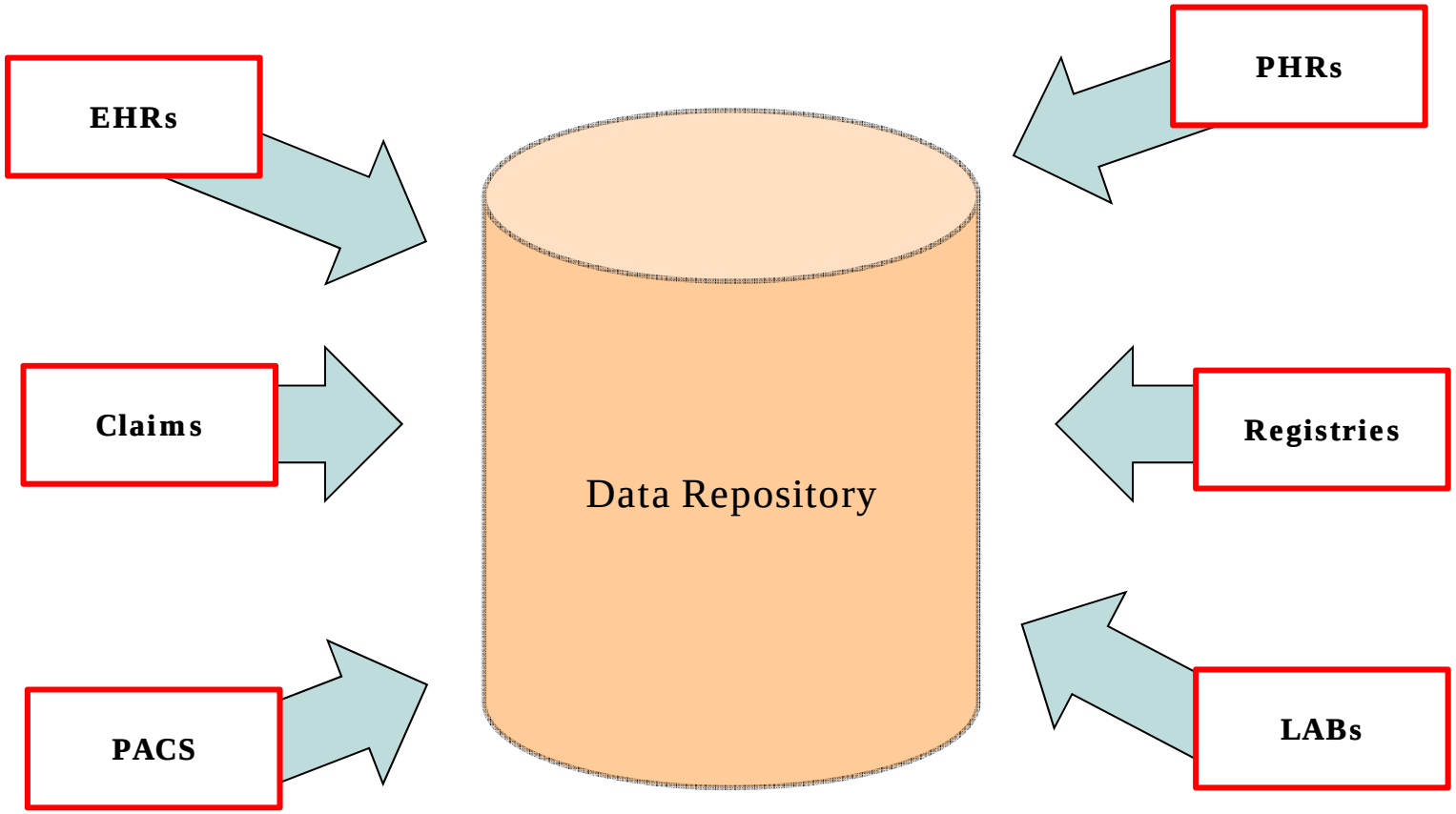
HIE Architecture

- Architecture is a formal description of a system or a detailed plan of the system at component level, used to guide its implementation.
- It includes the structure of components, their interrelationships and the principles and guidelines governing their design and evolution over time.
- Four commonly used subsets of an overall enterprise architecture: Business (or business process) architecture; Application architecture; Data architecture; and, Technical architecture.
- HIE technical architectures:
  - Centralized (Monolithic data repository)
  - Federated (Consistent & Inconsistent)
  - Hybrid
  - Switch (Service Oriented / Web Services)
  - Patient Centric (PHR oriented)

HIE Architecture → Centralized

- Data is accumulated and managed in a single and centralized repository
- The state HIO has full control over the data and the ability to authenticate
- HIO is responsible for patient ID, data storage and privacy
- Users interact with centrally located and standardized content
- Example: UK NHS planned HIE
- **Advantages**:
  - Simplicity / efficiency
  - Data are consistent + no patient linkage issues
- **Disadvantages**:
  - Doesn't scale well
  - Single point of control – must trust the custodian
  - Requires exceptional leadership
  - Everyone has to accept the same identifier
  - Needs robust communication infrastructures

HIE Architecture → Centralized *(cont.)*



Centralized HIE

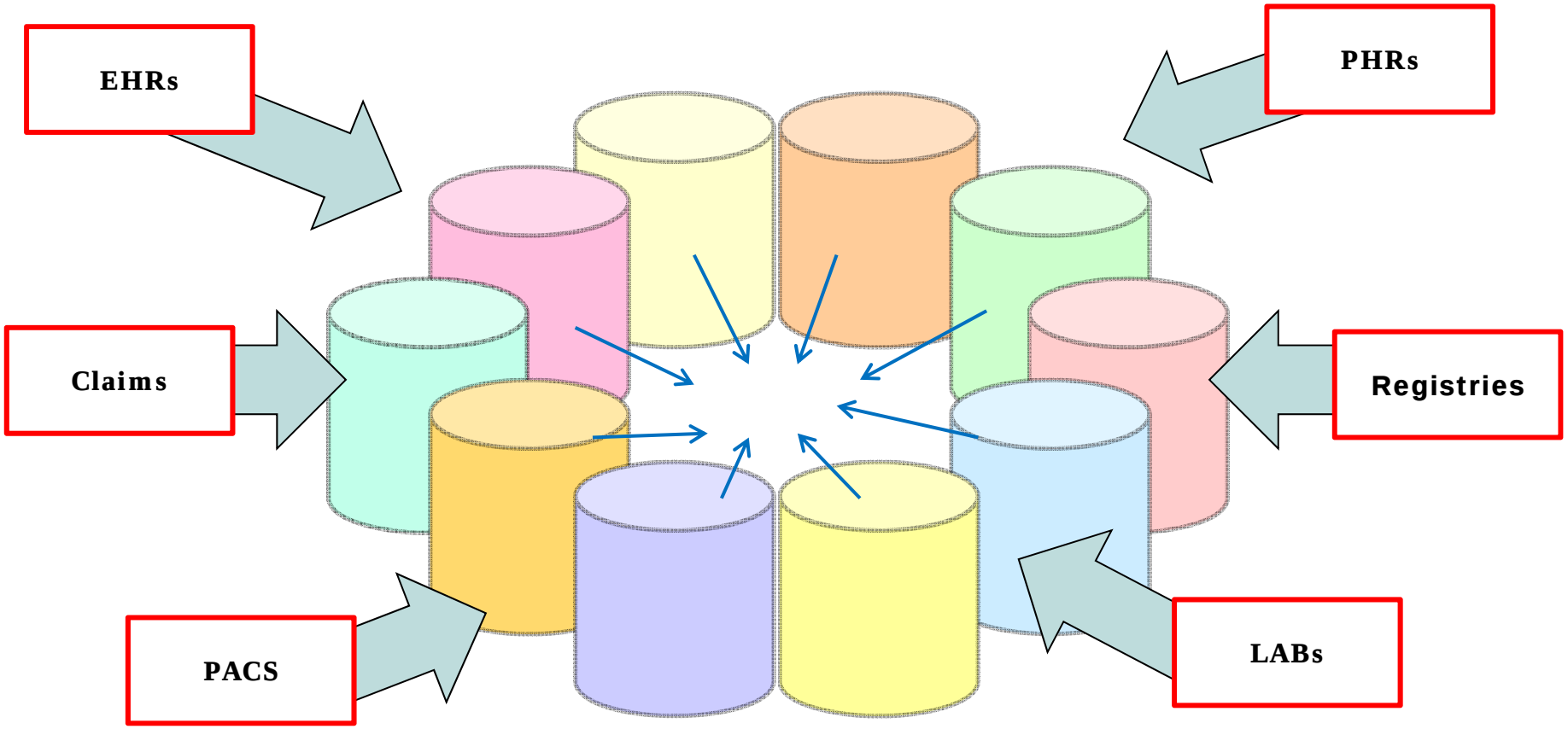
HIE Architecture → Federated

- Peer-to-peer architecture.
- Network permits users access only when needed.
- Multiple patient id technologies: Master Patient Indices (MPI) and Record Locator Service (RLS).
- **Inconsistent**: includes non-standardized data such as different patient identifiers; different data models (basic way to organize the data); different identifiers for observations (e.g. hemoglobin, Hgb or WB Hemoglobin); and, different units
- **Consistent**: data gathered centrally in separate physical files, "mirrors" of remote sites; and, standardized at the time it comes in.
- Examples:
  - Inconsistent: Santa Barbara County Care Data Exchange
  - Consistent: Indiana HIE

HIE Architecture → Federated *(cont.)*

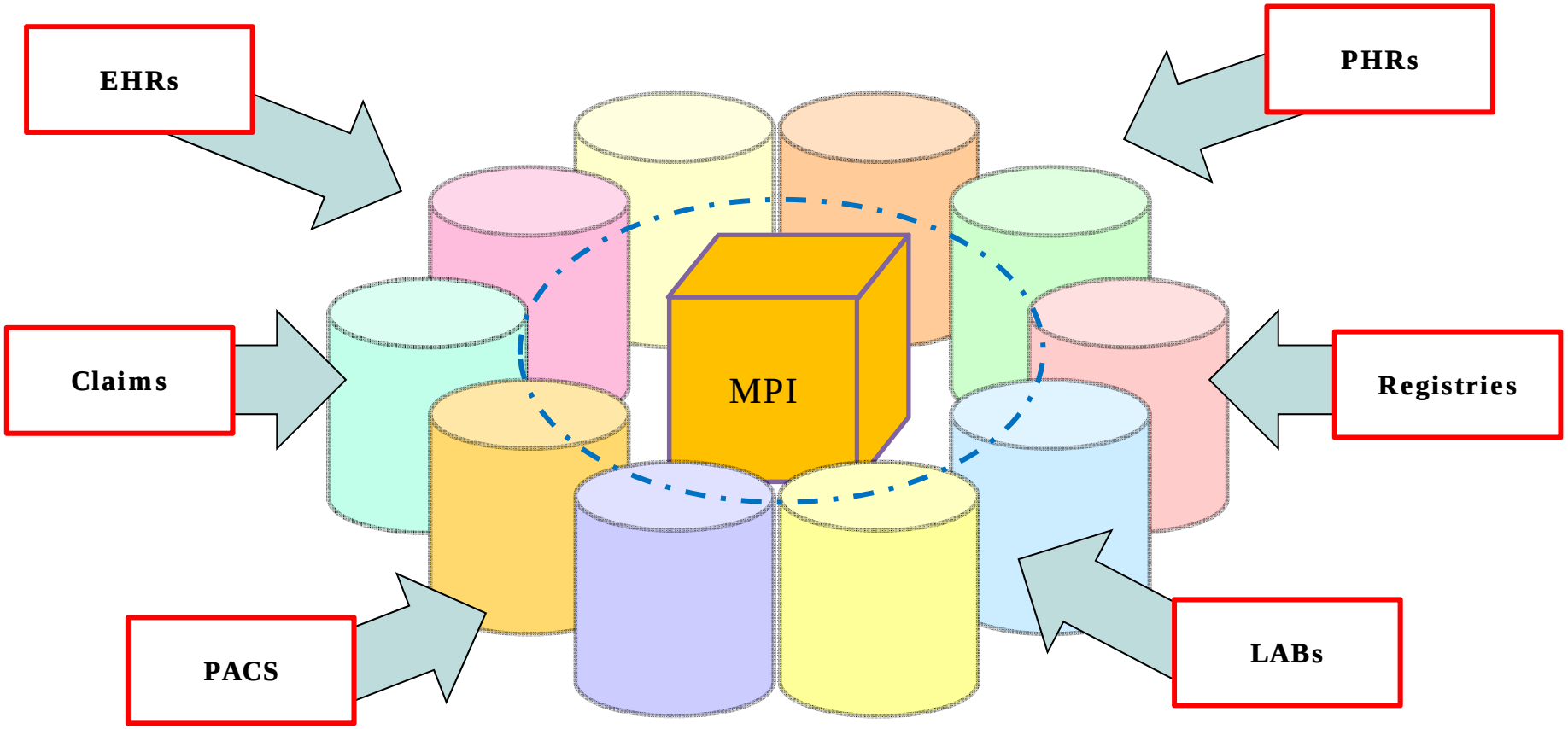
- **Advantages**:
  - Data ownership can be managed by defining business policies
  - Individual organizations able to control their own data
  - Benefits of scale
  - Builds on existing infrastructure – no need for new computers
  - More opportunities for creativity (within the specified architecture)
  - the only examples of working interoperable healthcare systems
- **Disadvantages**:
  - Requires more coordination
  - May be slower than monolithic database
  - Have to solve the patient identifier problem
  - Also needs robust communication infrastructure in place

HIE Architecture → Federated *(cont.)*



Federated Inconsistent HIE

HIE Architecture → Federated *(cont.)*

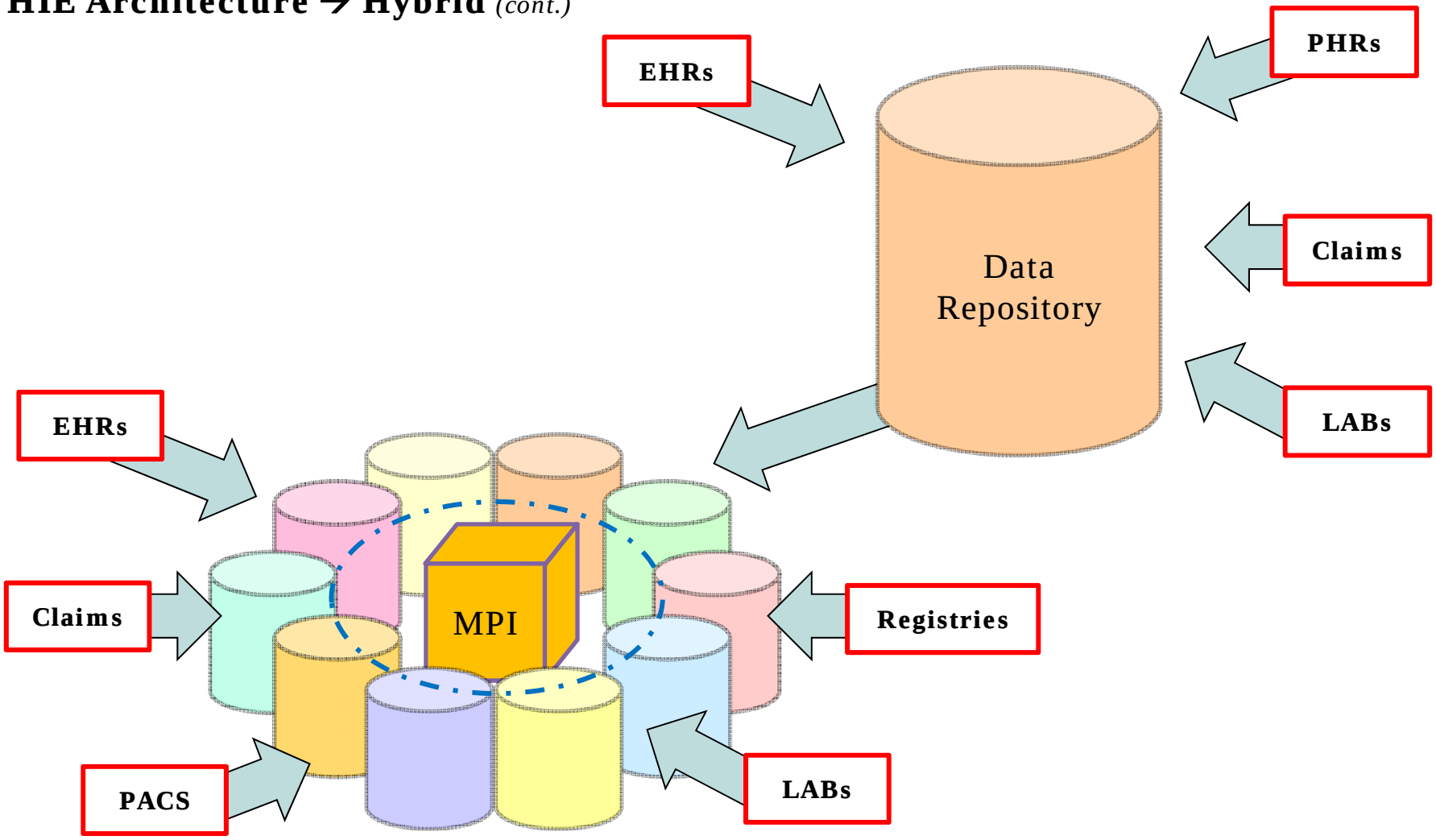


Federated Consistent HIE

HIE Architecture → Hybrid

- A mix of Centralized and Federated models
- Centralization or distribution is dependent on specific requirements
- MPI is used to link patient records across databases
- User interface brings together patient information from various sources
- Advantages and disadvantages depend on the centralized and federated components of the hybrid model

HIE Architecture → Hybrid *(cont.)*

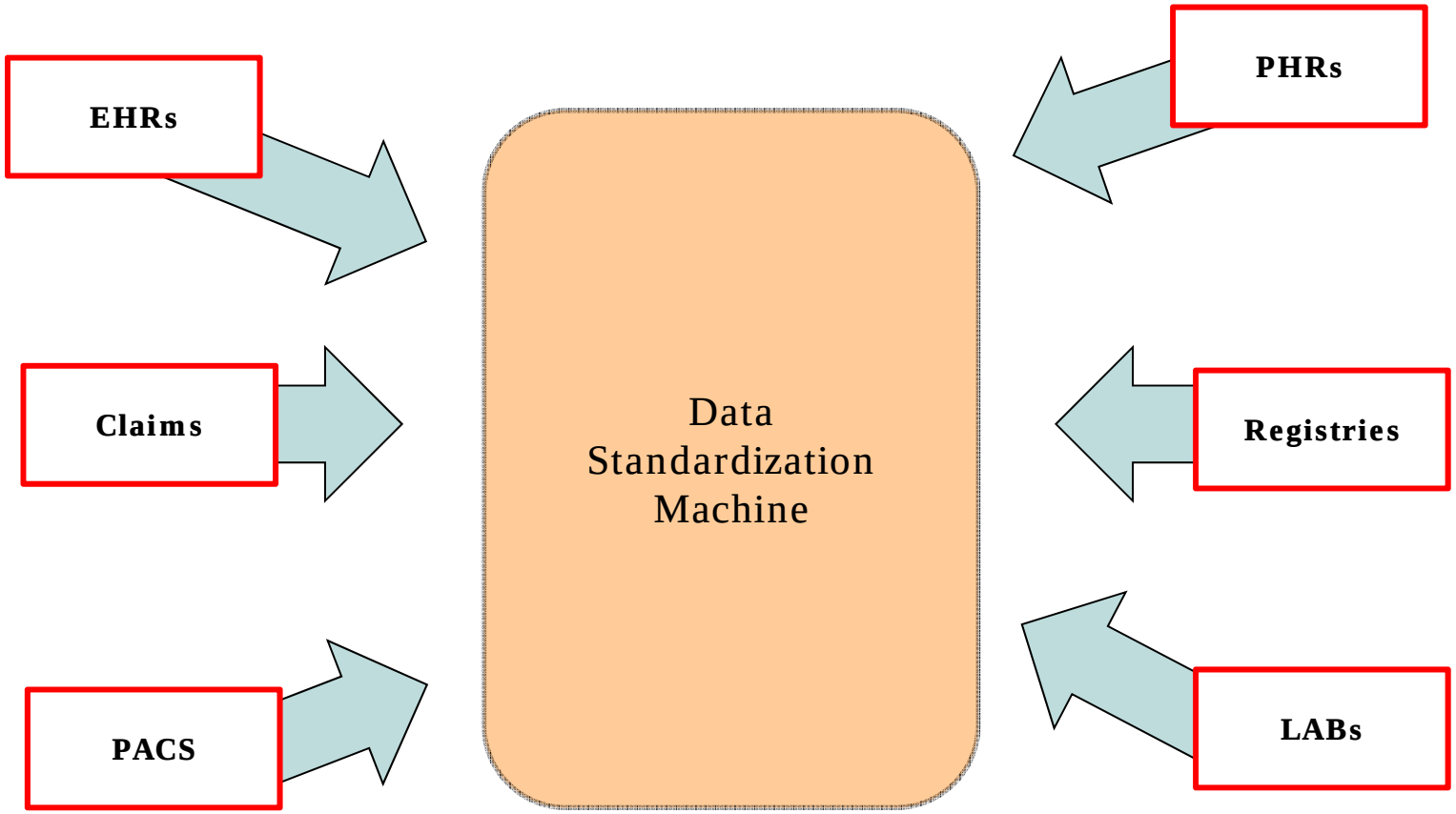


Hybrid HIE

HIE Architecture → Switch

- Data gathered centrally in separate physical files, "mirrors" of remote sites
- Standardized at the time it comes in
- No data storage
- Example: Utah Health Information Network (UHIN)

HIE Architecture → Switch *(cont.)*

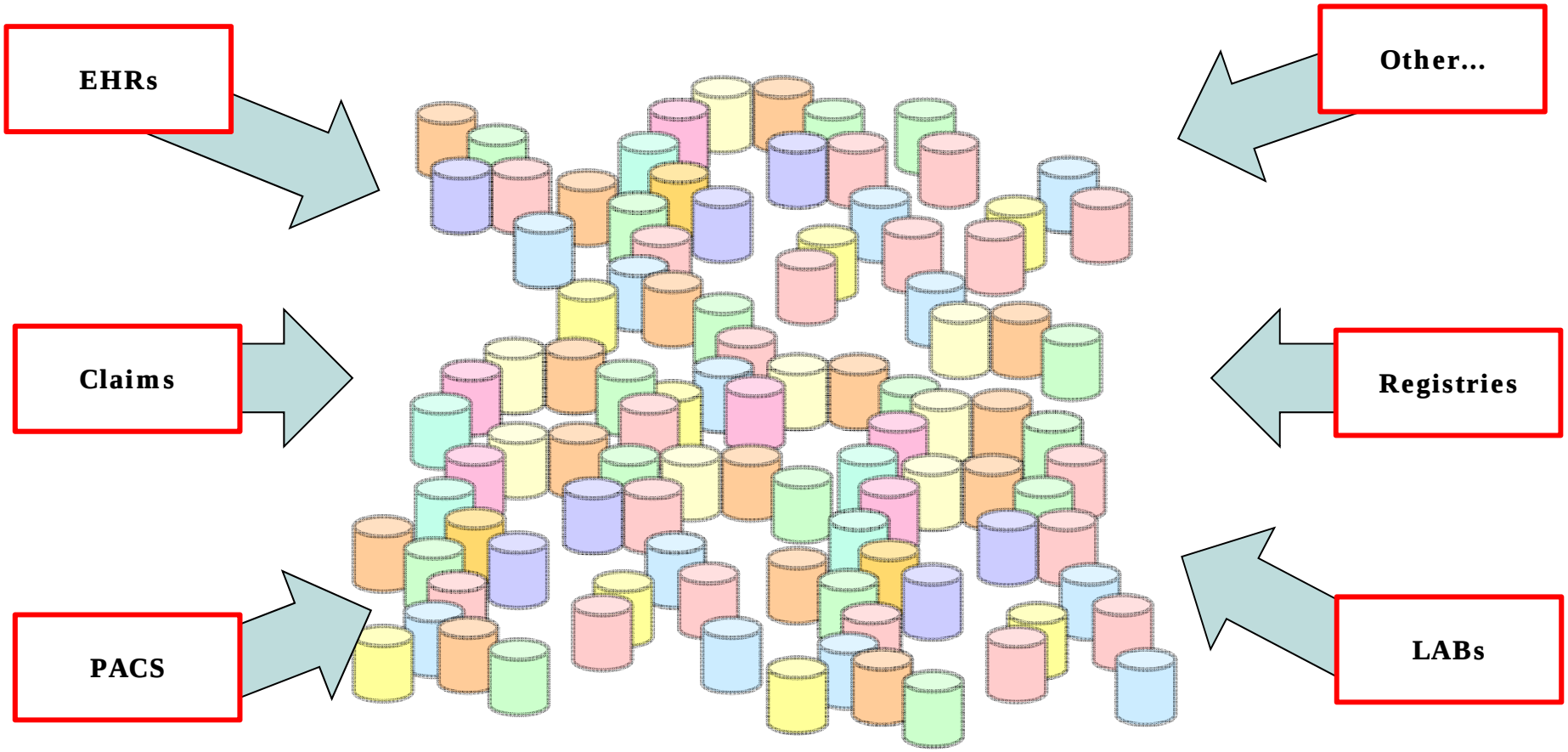


Switch HIE

HIE Architecture → Patient Centric

- Standardized data set managed by each individual
- Infrastructure at clinical sites to interact with data
- **Advantages**:
  - Direct patient control
  - Patient controls access
  - Security is in the hands of the person at risk
  - Can serve as a token
- **Disadvantages**:
  - Update problems – hard to get the data to the card when asynchronously generated (i.e. after patient leaves)
  - Risk of loss
  - Does not facilitate research or public health use
  - Patient authentication

HIE Architecture → Patient Centric *(cont.)*



Patient Centric HIE (e.g., PHR controlled)

HIE Architecture → Useful Resources

- http://www.connectopensource.org/

HIE Architecture → Useful Resources *(cont.)*

- http://www.mirthcorp.com/community/downloads

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HIE Services

HIE Services → Core Services

- Each HIE may have data services that vary based on defined requirements.
- **Presentation Services**
  - Format data displays to meet end user interaction and display device requirements.
  - Examples: login, patient look-up, request patient records, view data
- **Business Application Services**
  - Key functional components that house rules and execute business logic on clinical data to render.
  - Examples: e-Prescribing, EMR, lab, radiology, eligibility checking, problem list/visit history
- **Data Management Services**
  - Manage application access to data storage and processing of data in the storage layer.
  - Examples: data persistence/access, value/code sets, key management

HIE Services → Core Services *(cont.)*

- **Data Storage Services:**
  - Provide reliable, secure data storage for efficient access by data management services.
  - Examples: message logs, XML Schemas, Provider/User Directory
- **Integration Services:**
  - Manage integration services across the different layers of the technology stack.
  - Examples: message translation/transport, HL7 mapping, EMR adapter
- **System Management Services:**
  - Provide system and application administrative and management support.
  - Examples: system configuration, audit/logging, exception handling

HIE Services → Core Services *(cont.)*

- **Security Services**:
  - Manage the implementation of security to control system access and protect confidentiality and integrity of data in the system.
  - Examples: authentication/authorization, consent management, user roles, policy management

- Some concrete examples:
  - Clinical results delivery: Lab, Radiology, etc.
  - Clinical information, notes & documents
  - Medication history, summaries, alerts, etc.
  - Immunizations, syndromic surveillance and public health data
  - Electronic prescribing, refill information
  - PHRs, patient-reported data
  - EMT, 1st responder notes
  - Claims transaction / electronic eligibility information
  - Data quality and research support documents

HIE Services → Data Services by Constituency

- **Hospitals**
  - Clinical messaging
  - Medication reconciliation
  - Shared EHR
  - Eligibility checking
- **Physicians**
  - Result reporting
  - Secure document sharing
  - Shared EHR
  - Clinical decision support
  - Eligibility checking
- **Laboratory**
  - Clinical messaging
  - Orders
- **Public Health**
  - Needs assessment
  - Biosurveilance
  - Reportable conditions
  - Results delivery
- **Consumers**
  - Personal Health Records
- **Researchers**
  - De-identified longitudinal clinical data
- **Payers**
  - Quality measure
  - Claims adjustment
  - Secure document transfer

HIE Services → Emerging Services

- Next Generation Analytics
  - Data warehouse, data analytics and business intelligence
  - Quality reporting support
  - Performance management
  - Fraud and abuse identification and prevention
  - Population monitoring and predictive profiling
  - Care gap identification
  - Care and disease management
  - Public health monitoring and analysis

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HIE Sustainability

HIE Sustainability

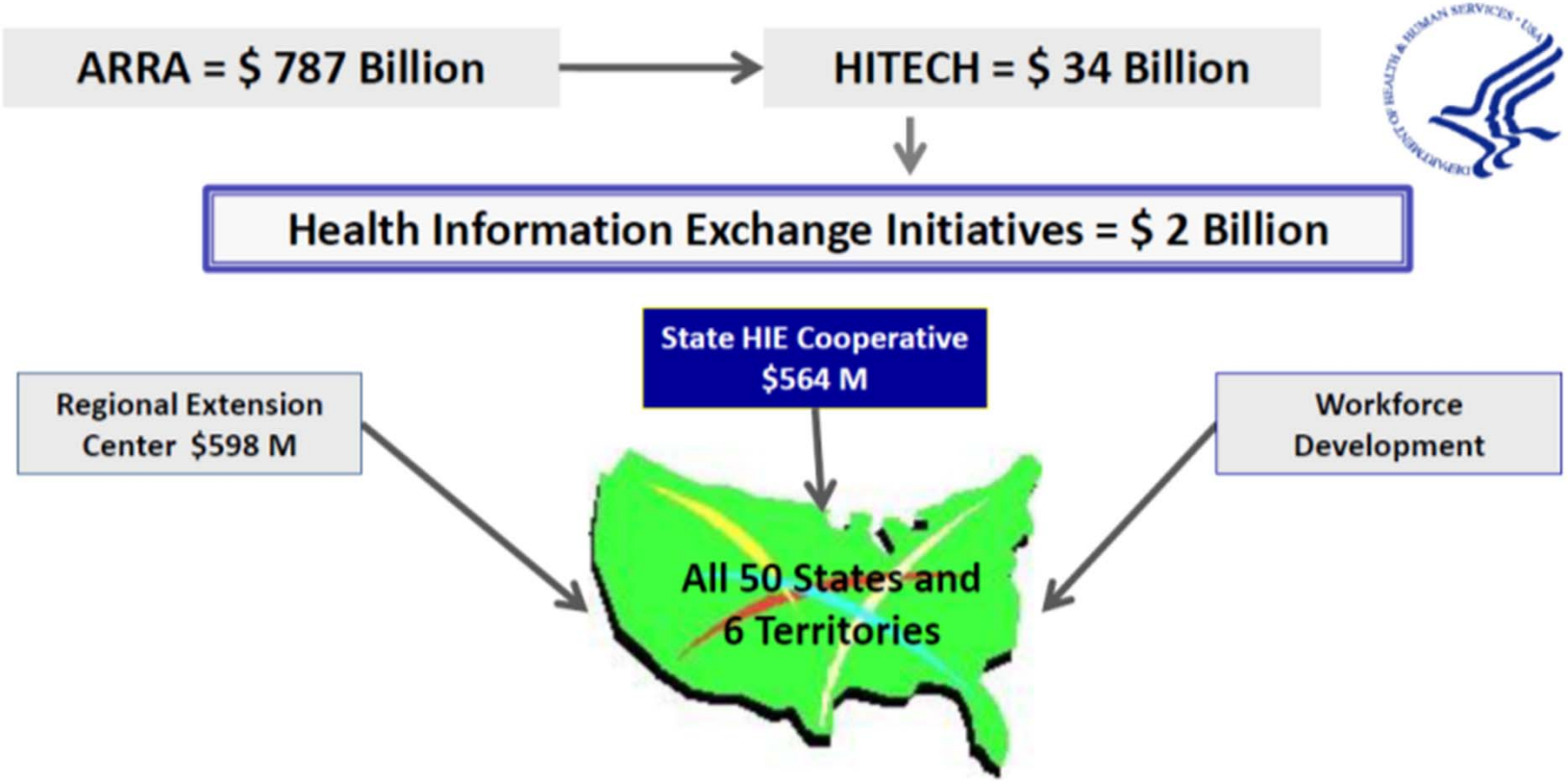
- **HIE Organizational Models**:
  - For-profit entity
  - Non-profit entity (501-C3 and other non-profit designations)
  - State agency or other government agency (e.g., State Level HIE)
- **Current Funding Options**: (short-term!)
  - Federal grants, federally funded IT programs and other contracts
  - State grants and state funded contract programs
  - Cash loans with scheduled payback
  - In kind services
  - Financial donations

HIE Sustainability *(cont.)*

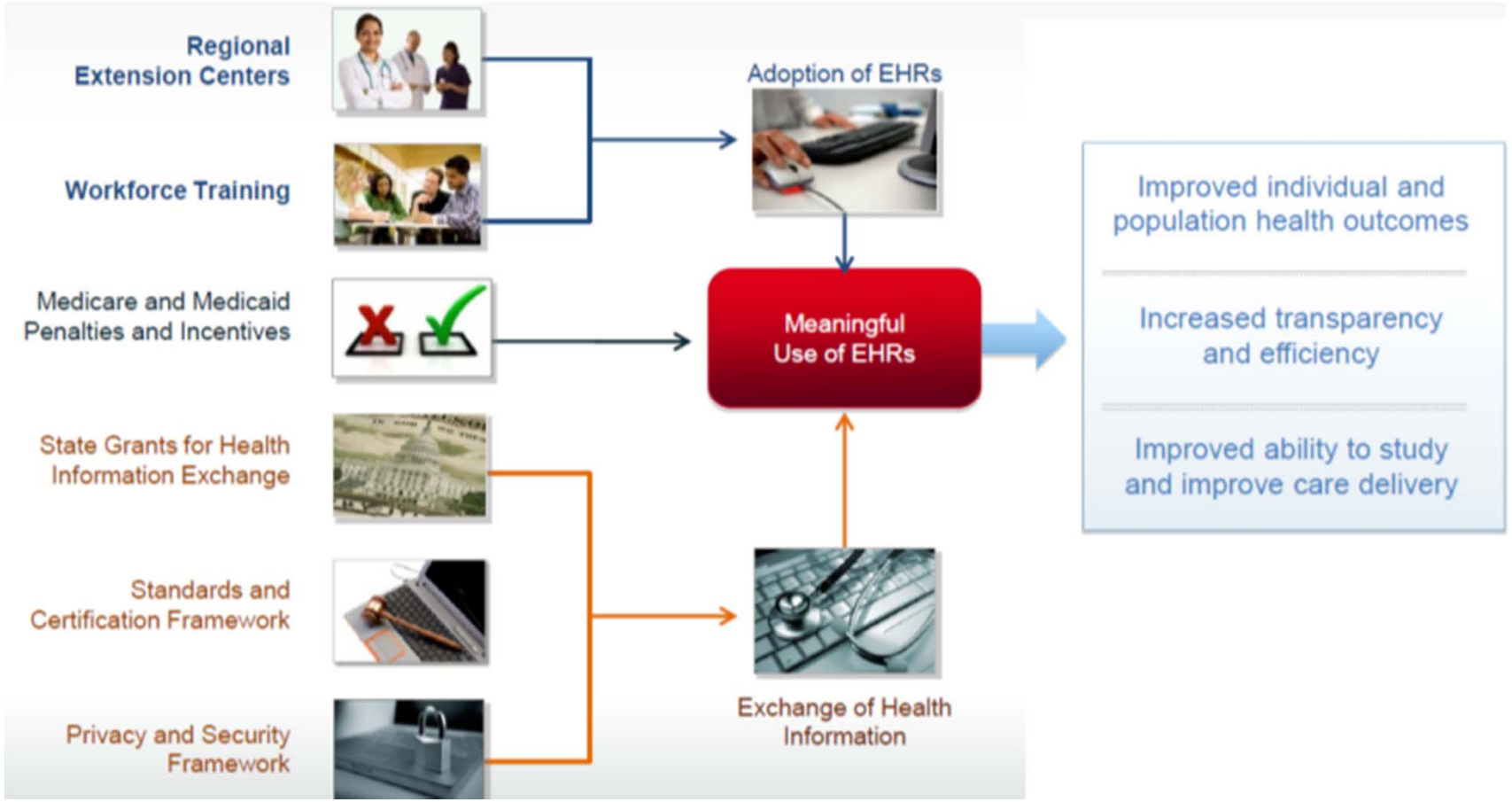
- **HIE Revenue Types**:
  - Membership Fees: Stakeholders pay to support shared services for all users of the electronic HIE
  - Transaction Fees: Fees for data-exchange services
  - Program and Service Fees: HIO acts in a programmatic capacity and charges stakeholders for their participation
  - Combination of Sources
  - Other Funding Streams: This includes providing value-added services in the form of "EHR-lite" functionality
- **HIE sustainability challenges**:
  - Funding Challenges: Start-up funding; Interfaces; Interoperability; Integration; and, Maintenance
  - Interoperability Challenges: evolution of standards
  - Maintaining solid data integrity with data exchange: NLP challenges
  - Privacy protection: Consent models; Segmentations

HIE Sustainability → Federal Impact

- 2009 The American Reinvestment and Recovery Act (ARRA) is signed into law which includes The Health Information Technology for Economic and Clinical Health Act (HITECH).



HIE Sustainability → Federal Impact *(cont.)*



The HITECH Act's Framework for Meaningful Use of EHR

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HIE Sustainability → Federal Impact *(cont.)*

- Two Specific HITECH Programs Directly Supporting HIEs:

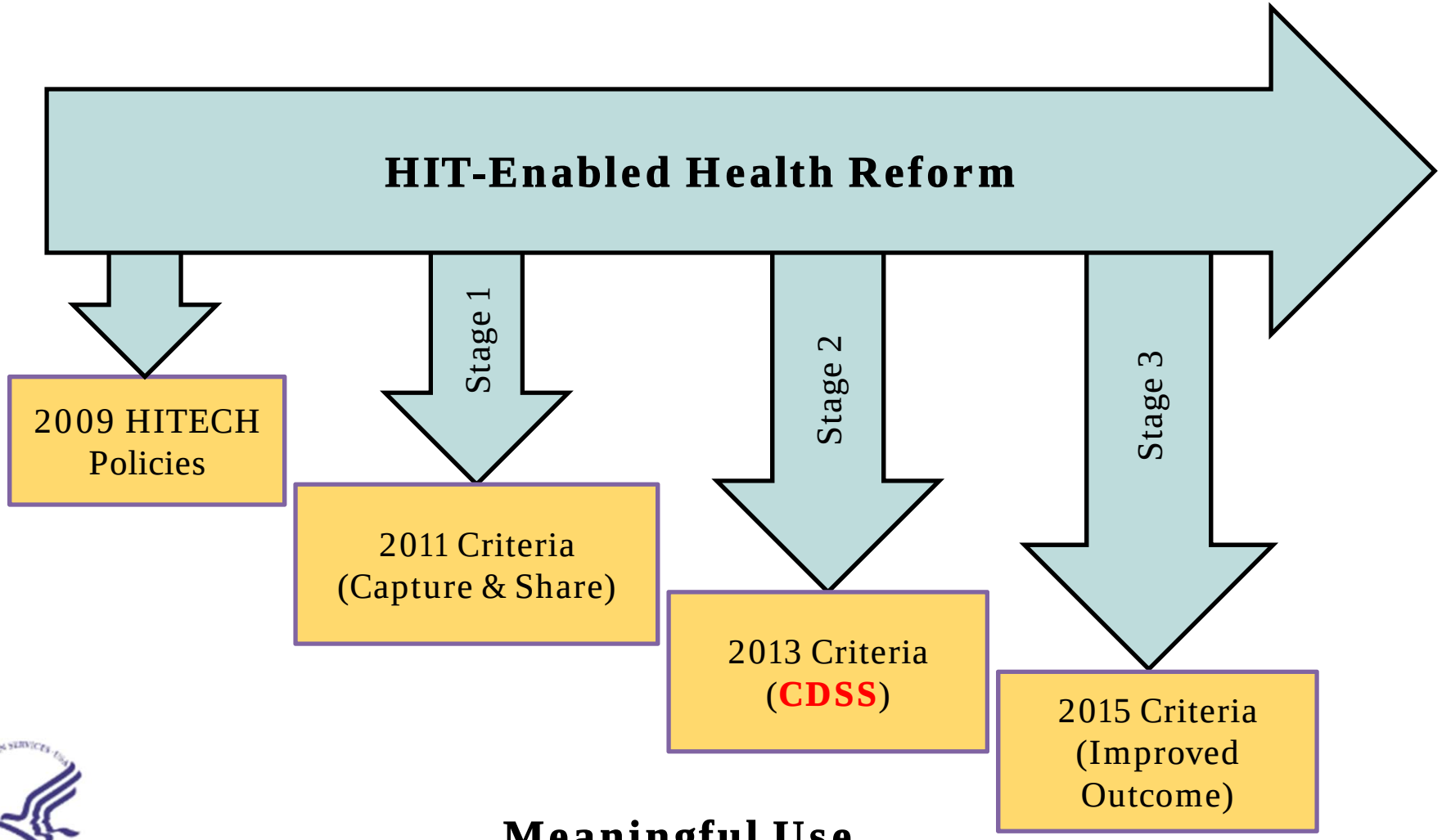
- **State Health Information Exchange**

  Facilitate and expand the secure electronic movement and use of health information among organizations according to nationally recognized standards. This program will be a federal-state collaboration aimed at the long-term goal of nationwide HIE (NwHIN) and interoperability. ($590M)

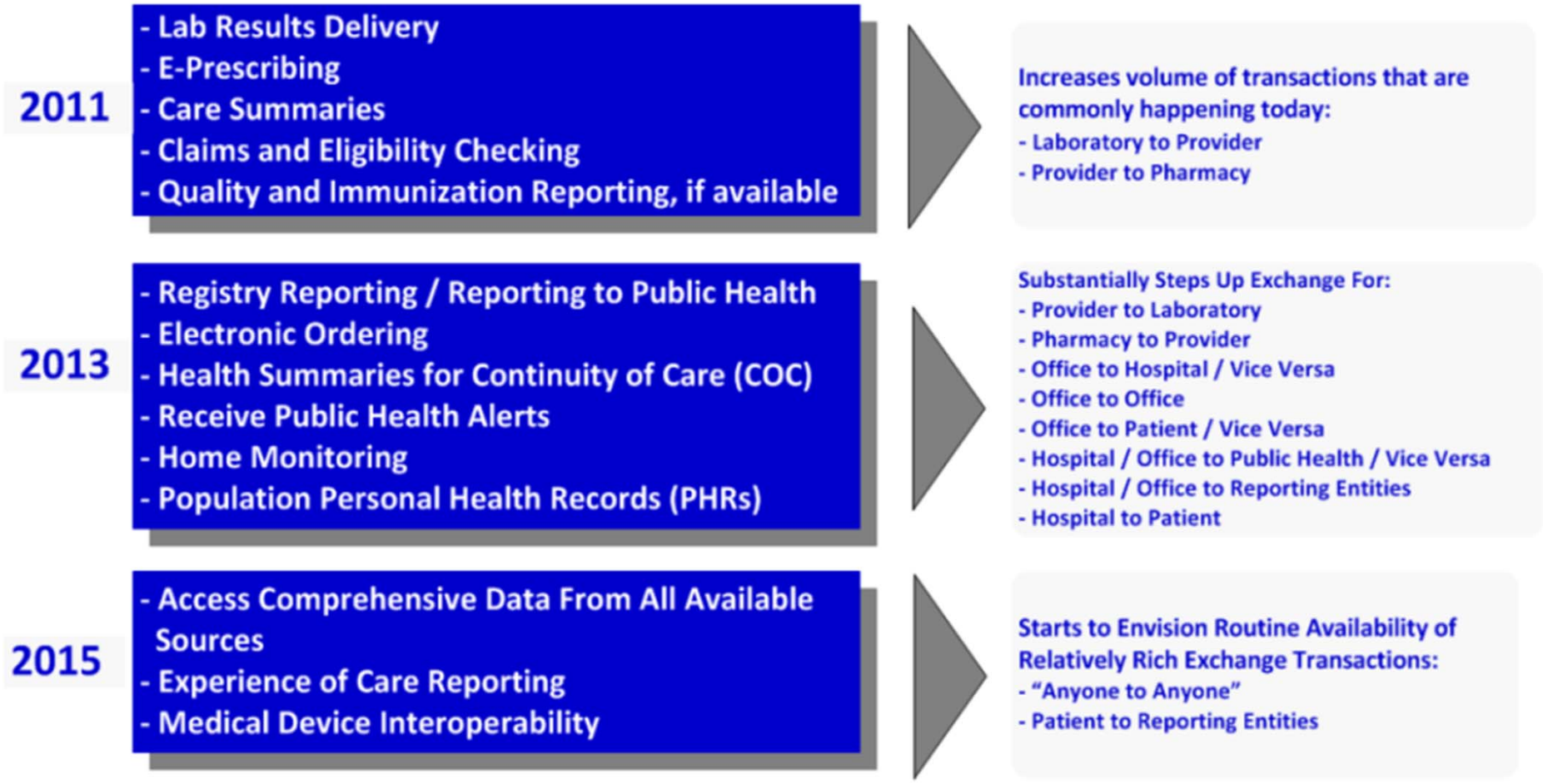
- **"Beacon" Community Program**

  Define best practices in the adoption and use of HIT that other communities may emulate. ($220M)

HIE Sustainability → Federal Impact *(cont.)*



HIE Sustainability → Federal Impact *(cont.)*



Meaningful Use objectives requiring HIEs

HIE Sustainability → State Impact

- The states themselves are an important entity in the progression of HIE initiatives. Some of the areas in which the states engage include:
- **State-Specific Office**: To manage federal funds and support the strategic planning process for HIEs.
- **State Privacy Laws**: There are nuances in the privacy laws and this information is critical to participants within each HIE.
- **Inter-State Commerce Issues**: While most HIEs have a state-specific focus, there are other HIEs that span across borders to another state(s). Inter-State Commerce concerns must be considered for HIEs.
- **Trust Domains**: In order to ensure security when accessing or storing information, Trust Domains have been created. They are a framework that takes into consideration those requirements and standards.

HIE Sustainability → State Impact *(cont.)*

- **State Privacy laws**

  - Privacy laws at the state level are not identical.

  - If you participate in an HIE, a **Business Associate Agreement (BAA)** is required to ensure protection of privacy for patient information. These agreements must be provided to each party that interacts with another party. As a result, there could be a very large number of BAAs in place to view or exchange patient data.

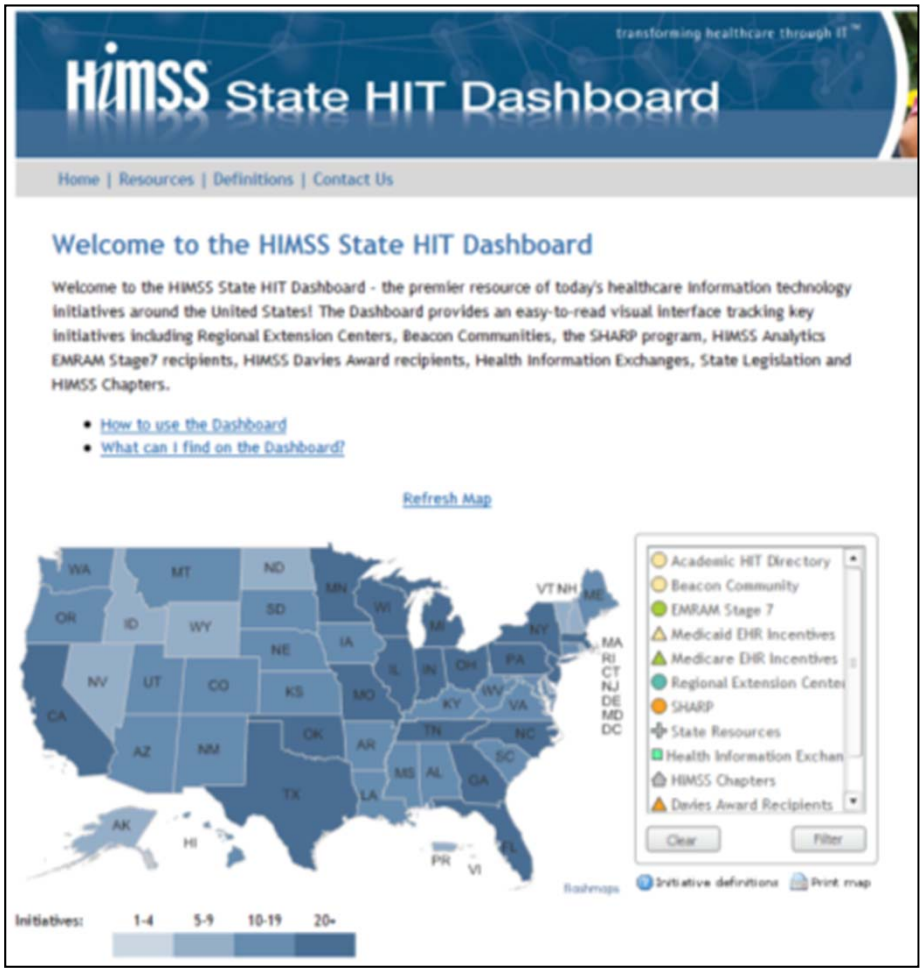
  - **Data Use and Reciprocal Support Agreement (DURSA)**: With the growing number of Business Associates that will be entering into an HIE, there was a need to simplify the arrangement between and among those associates. DURSA is a policy which allows one agreement to be signed for all participants within the NwHIN initiative.

HIE Sustainability → State Impact *(cont.)*

- To gain a better understanding of the HIE activities at each state level, http://statehieresources.org/ can provide a variety of information to assist you.

HIE Sustainability → State Impact *(cont.)*

- More state level HIT initiatives at: http://www.himss.org/statedashboard/



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HIE Examples: IHIE and CRISP

HIE Examples → IHIE (Regenstrief Institute)

Regenstrief Institute
Advancing healthcare through research, development, and education

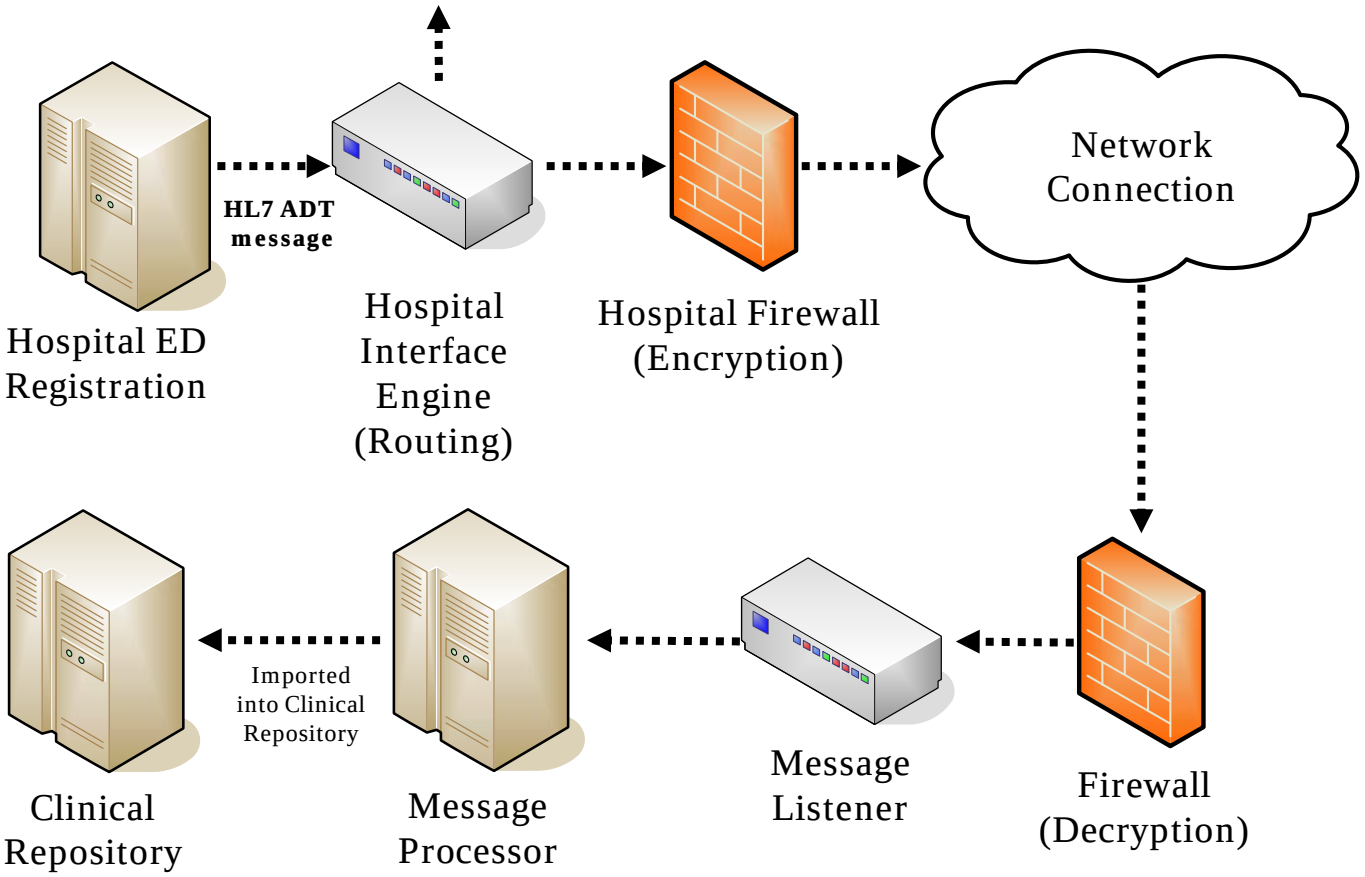
- Established in 1969 by philanthropist Sam Regenstrief
- Regenstrief receives $3 million per year in core support from the Regenstrief Foundation
- Annual operating budget of approximately $23 million derived from grants and contracts
- Logical Observation Identifiers Names and Codes (LOINC) system, a standard nomenclature that enables the electronic transmission of clinical data from laboratories
- Regenstrief Medical Records System (RMRS) was developed 35 yrs ago. RMRS has a database of 6 million patients, with 900 million on-line coded results, 20 million full reports including diagnostic studies, procedure results, operative notes and discharge summaries, and 65 million radiology images.
- Indiana Network for Patient Care (INPC) was created in 1996. It is a city-wide clinical informatics network of 11 different hospital facilities and more than 100 geographically distributed clinics and day surgery facilities

HIE Examples → IHIE *(cont.)*

- The Indiana HIE (IHIE) includes (as of mid-2011):
  - Federated Consistent Databases
  - 22 hospital systems → ~70 hospitals
  - 5 large medical groups and clinics & 5 payors
  - Several free-standing labs and imaging centers
  - State and local public health agencies
  - 10.75 million unique patients
  - 20 million registration events
  - 3 billion coded results
  - 38 million dictated reports
  - 9 million radiology reports
  - 12 million drug orders
  - 577,000 EKG tracings
  - 120 million radiology images

Indiana Health Information Exchange

HIE Examples → IHIE *(cont.)*

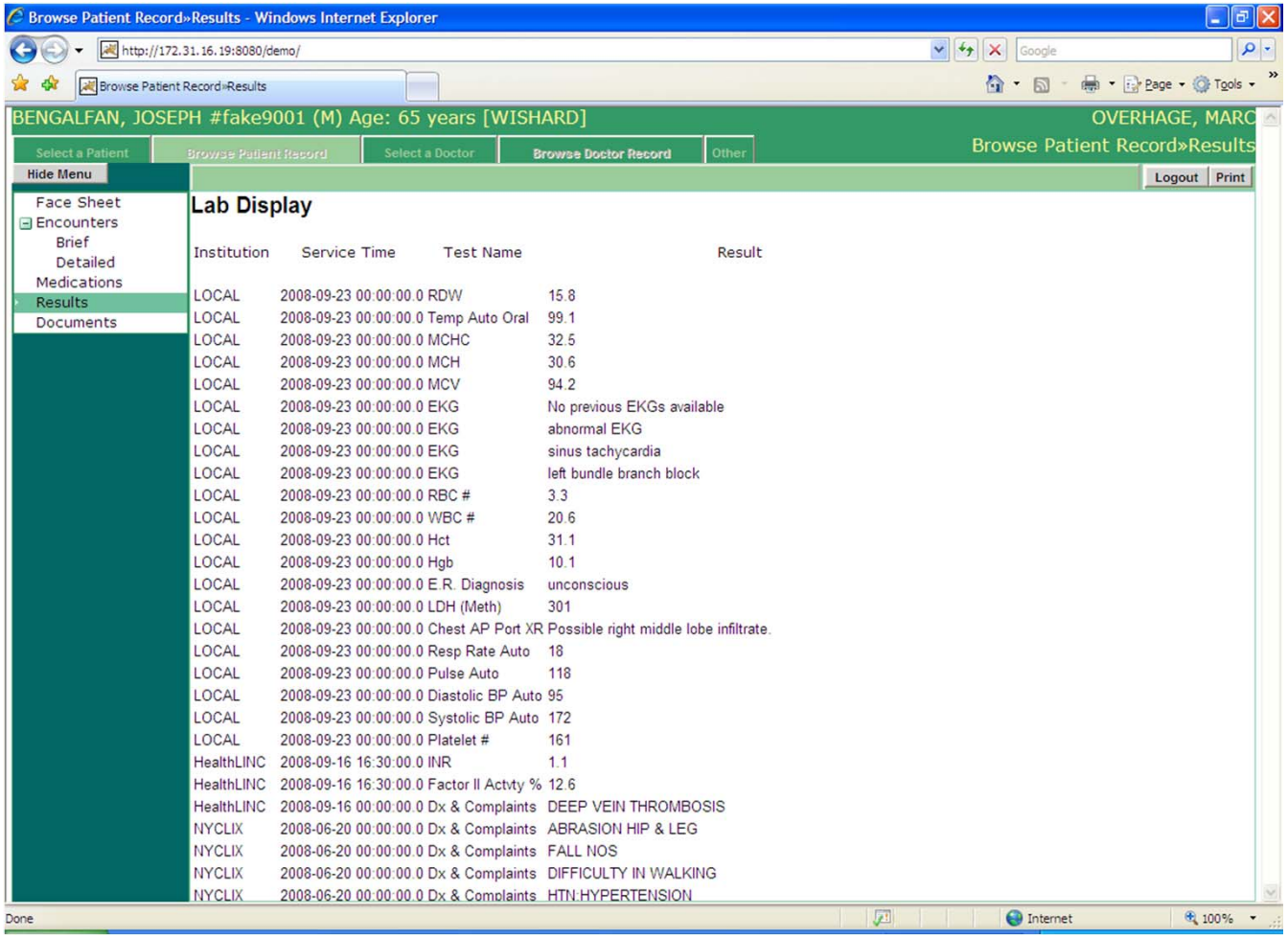


Information flow

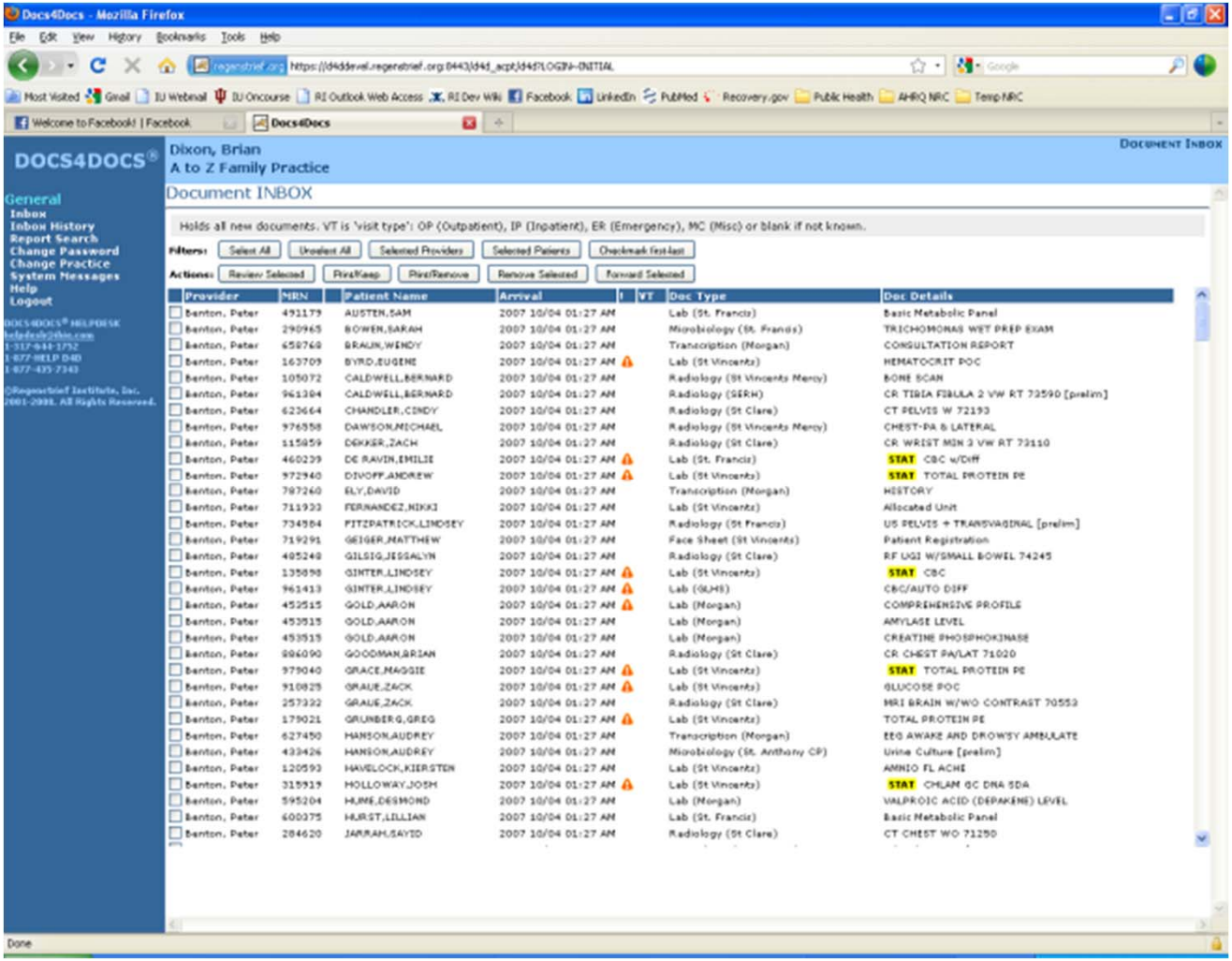
HIE Examples → IHIE *(cont.)*

- **Core Technologies**:
  - Master Patient Index
  - Vocabulary/Code Standardization
  - Master Provider Index
  - Message Processing Pipeline
  - Secure Data Transmission
  - Access Controls
  - Licensing
- **Data Integrity Checks**:
  - Source Validation
  - Data Cleansing
  - Quality Control
  - Message Flow Monitoring
  - Data Transmission Fail Over

HIE Examples → IHIE *(cont.)* → CareWeb (summary of care)



HIE Examples → IHIE *(cont.)* → Docs4Docs



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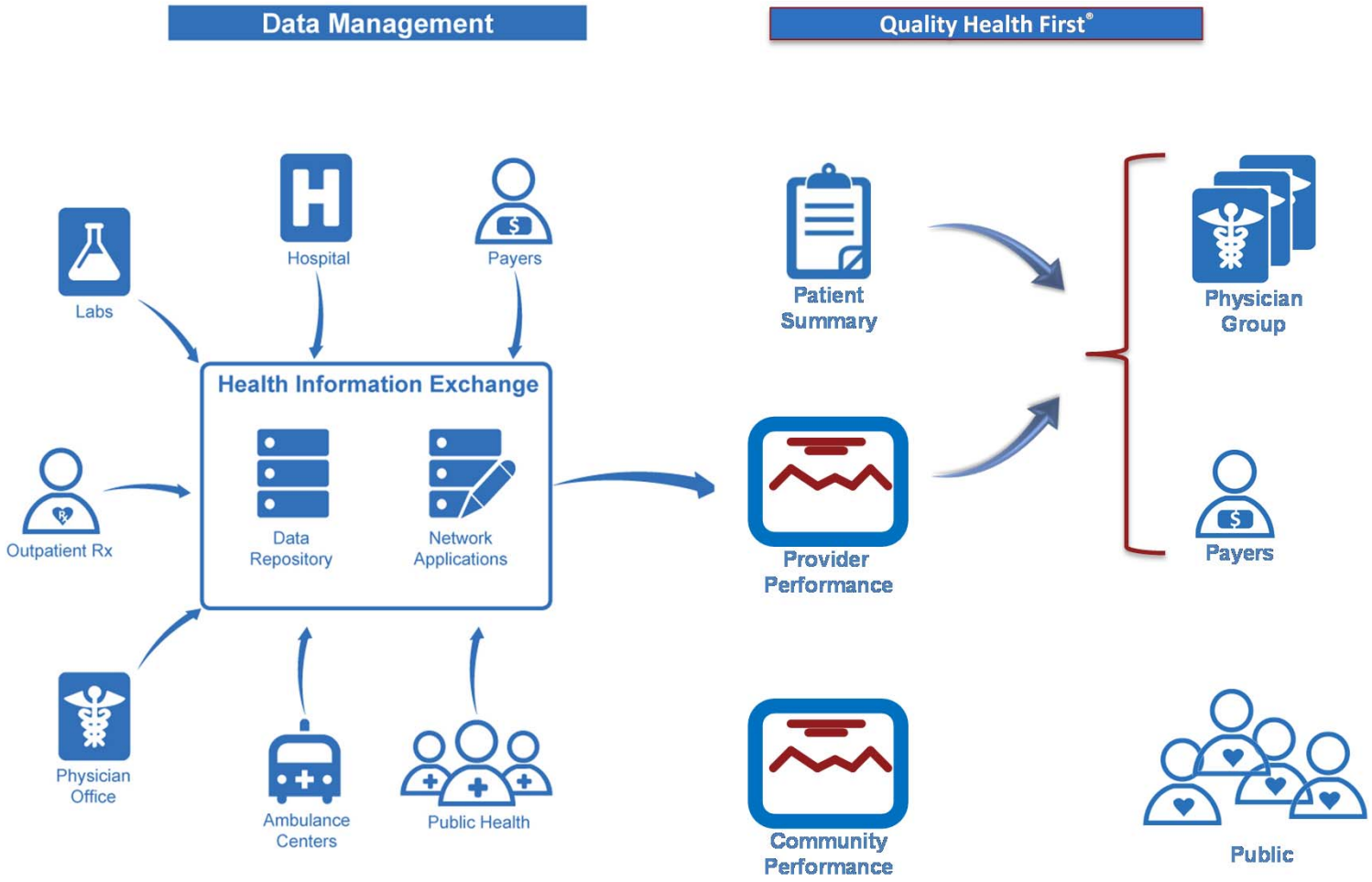
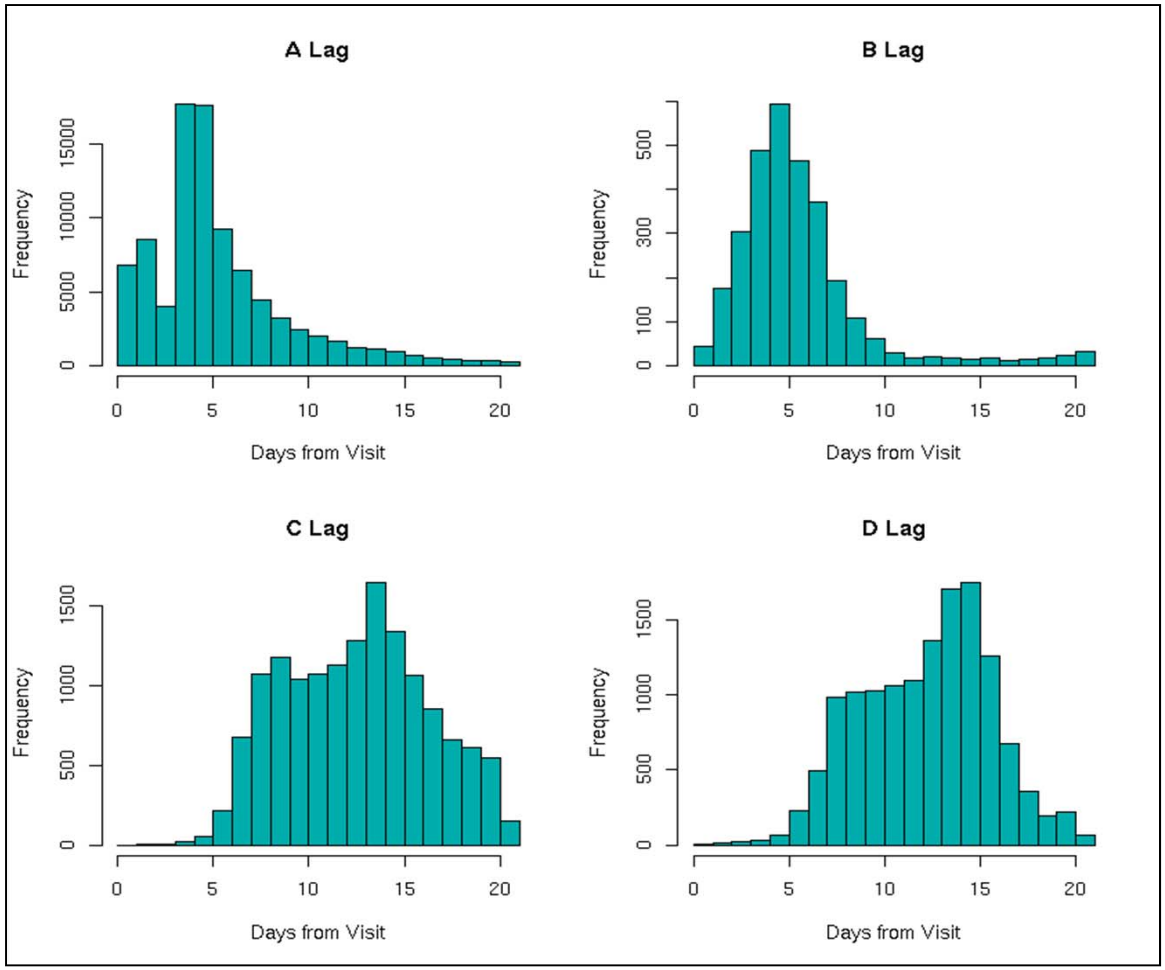
HIE Examples → IHIE *(cont.)* → Quality Health First (QHF)



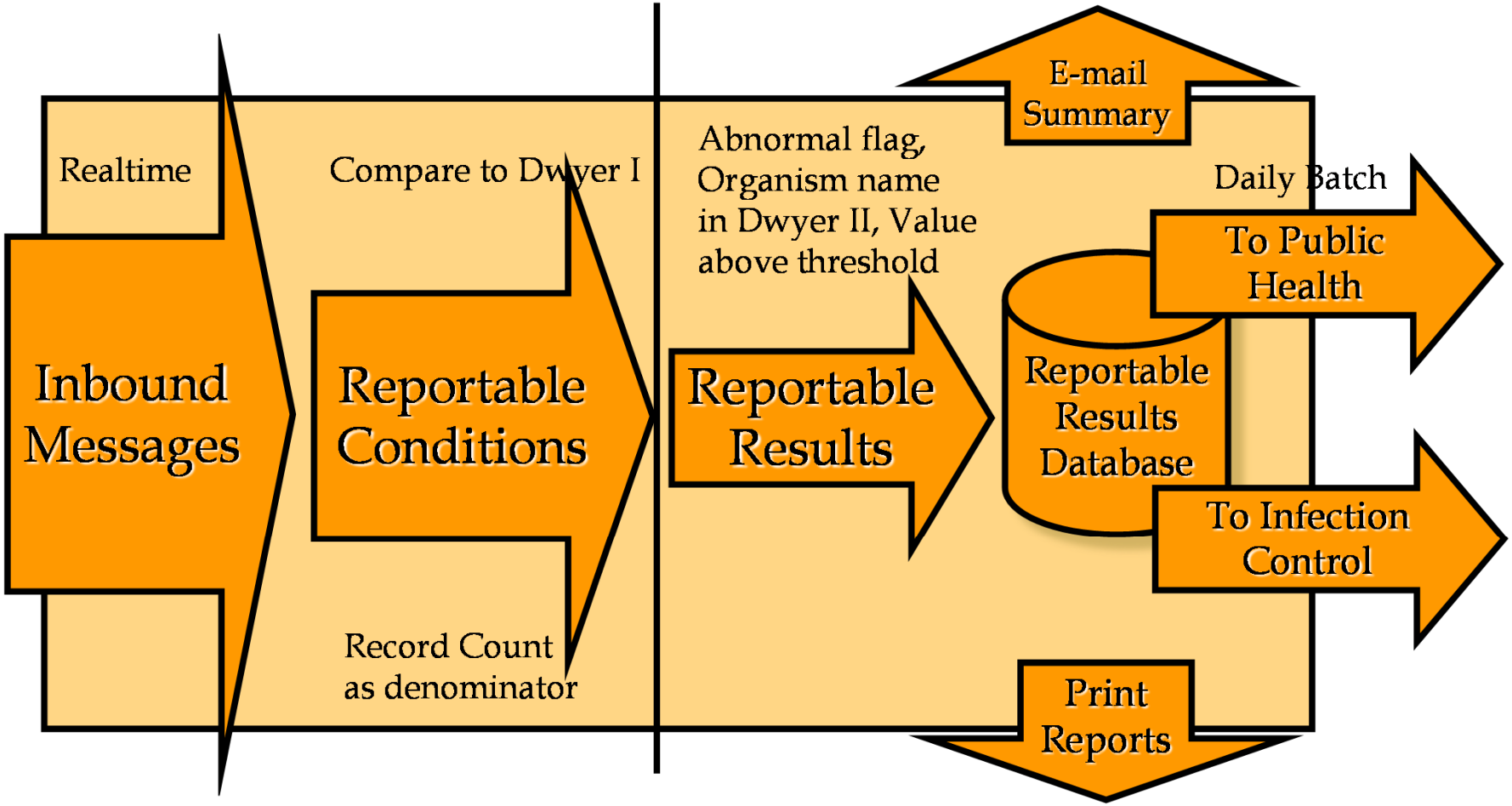
HIE Examples → IHIE *(cont.)* → ELR Data Completeness

Overhage JM, Grannis S, McDonald CJ. Am J Public Health. 2008 Feb

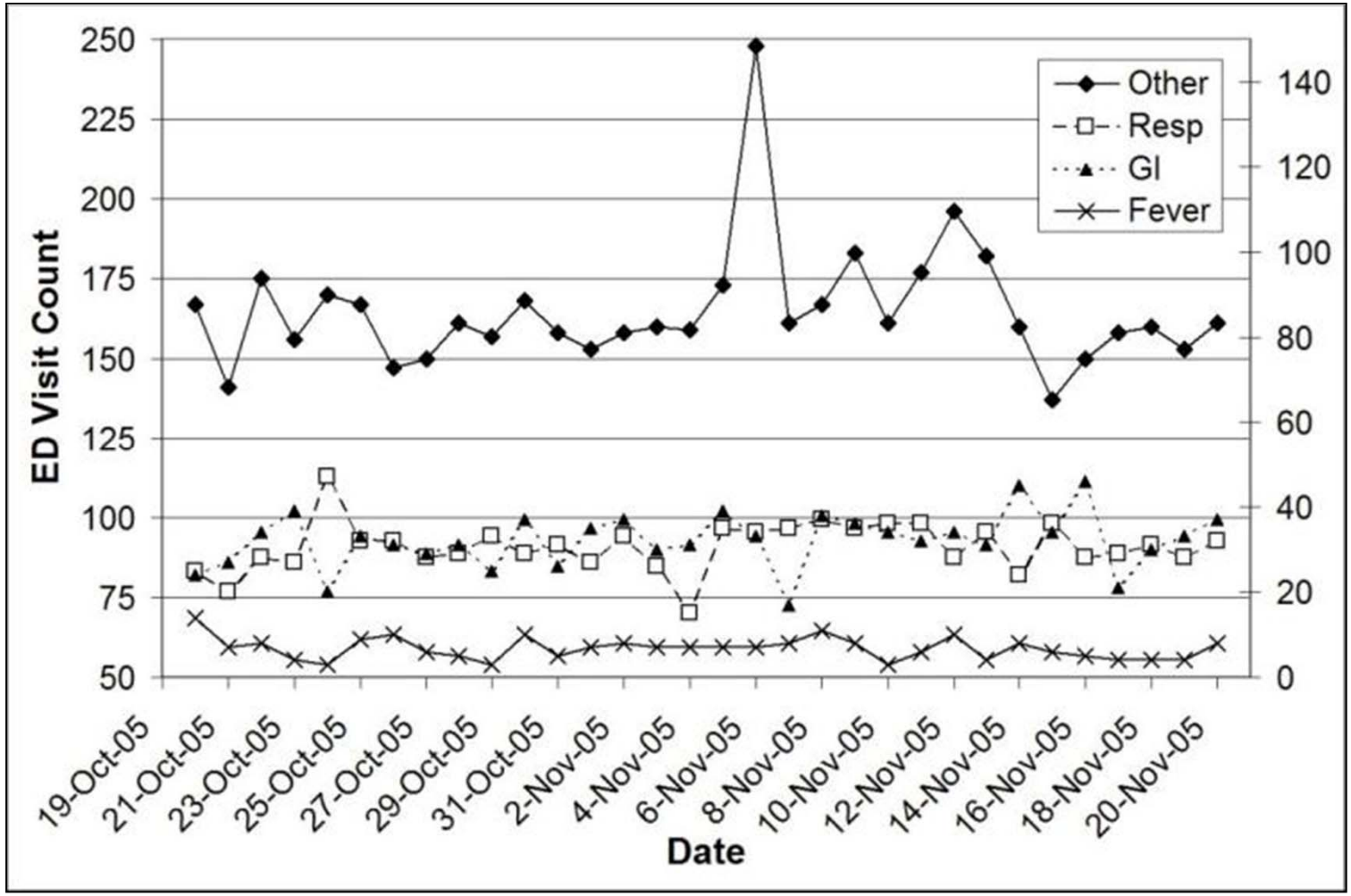
HIE Examples → IHIE *(cont.)* →Timeliness of Data (CC vs ICD9



HIE Examples → IHIE *(cont.)* →Notifiable Condition Detector (NCD)



HIE Examples → IHIE *(cont.)* →Syndromic Surveillance Service (SSS)



HIE Examples → CRISP (Chesapeake Regional Info. Sys. for our Patients)

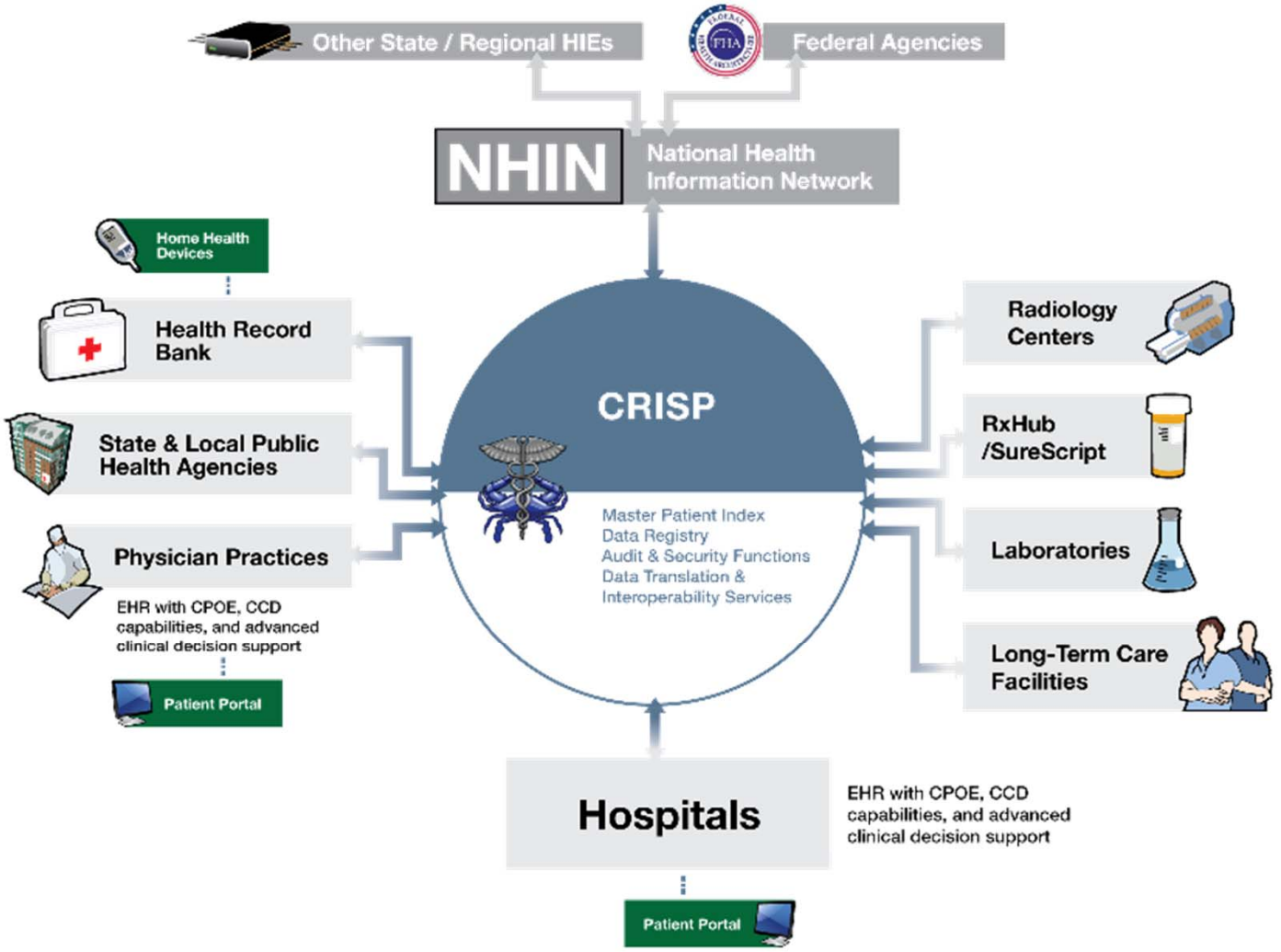
- **Mission**: To advance the health and wellness of Marylanders by deploying health information technology solutions adopted through cooperation and collaboration.

- **Vision**: Enable and support the Maryland healthcare community to appropriately and securely share data in order to facilitate care, reduce costs, and improve health outcomes.

- **Focus Areas**:
  - Query Portal Growth
  - Direct Secure Messaging
  - Encounter Notification System (ENS)
  - Encounter Reporting System (ERS)
  - Health Benefits Exchange integration

Copyright CRISP

HIE Examples → CRISP *(cont.)*



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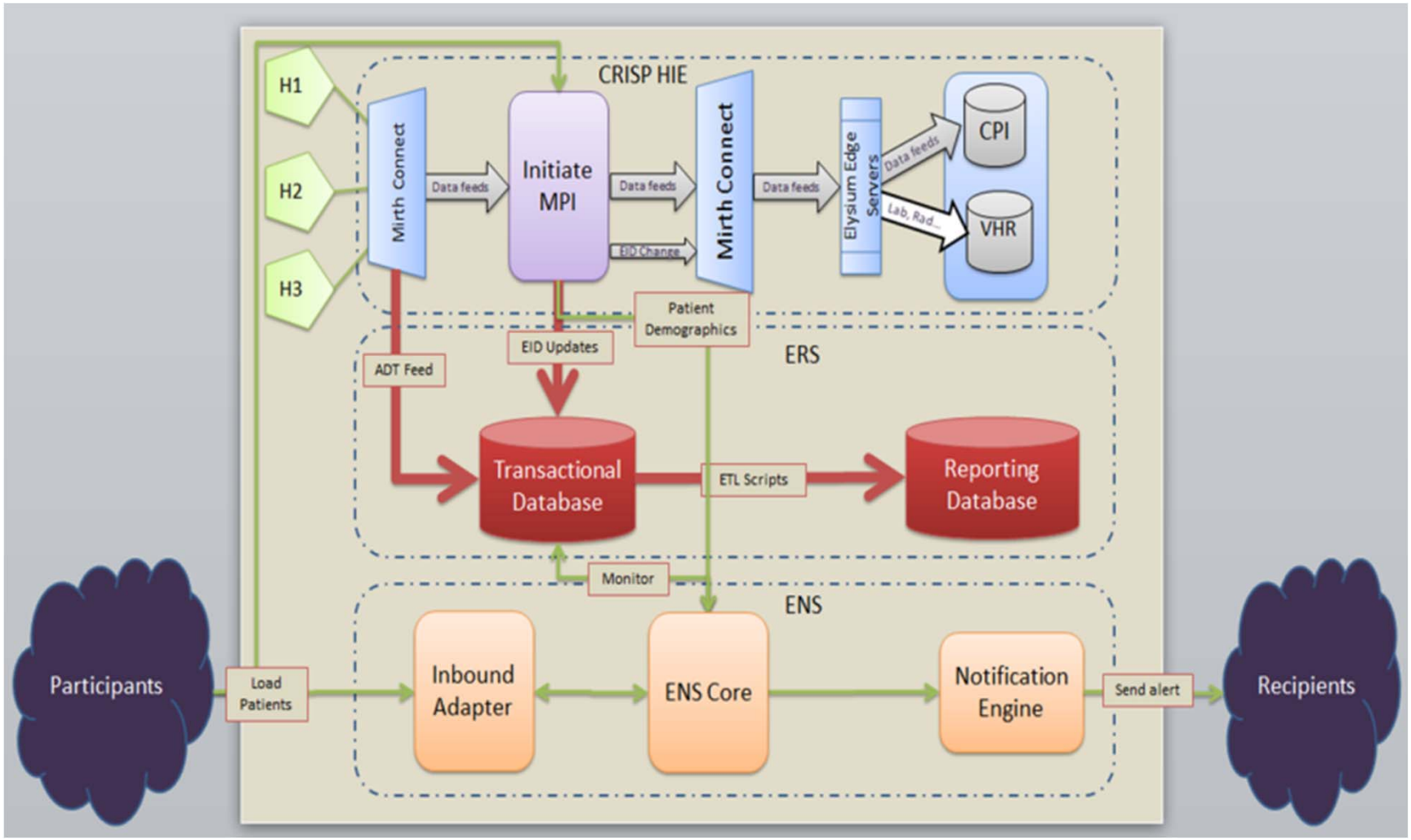
HIE Examples → CRISP *(cont.)*

Progress Metric	Result
Organizations Live	
Hospitals (Total 48)	48
Hospital Clinical Data Feeds (Total 143 - Lab, Radiology, Clinical Docs)	86
National Labs	2
Radiology Centers (Non-Hospital)	5
Identities and Queries	
Master Patient Index (MPI) Identities	~4M
Opt-Outs	~1500
Queries (Past 30 Days)	~3500
Data Feeds Available	
Lab Results	~16M
Radiology Reports	~5M
Clinical Documents	~2M

HIE Examples → CRISP *(cont.)*



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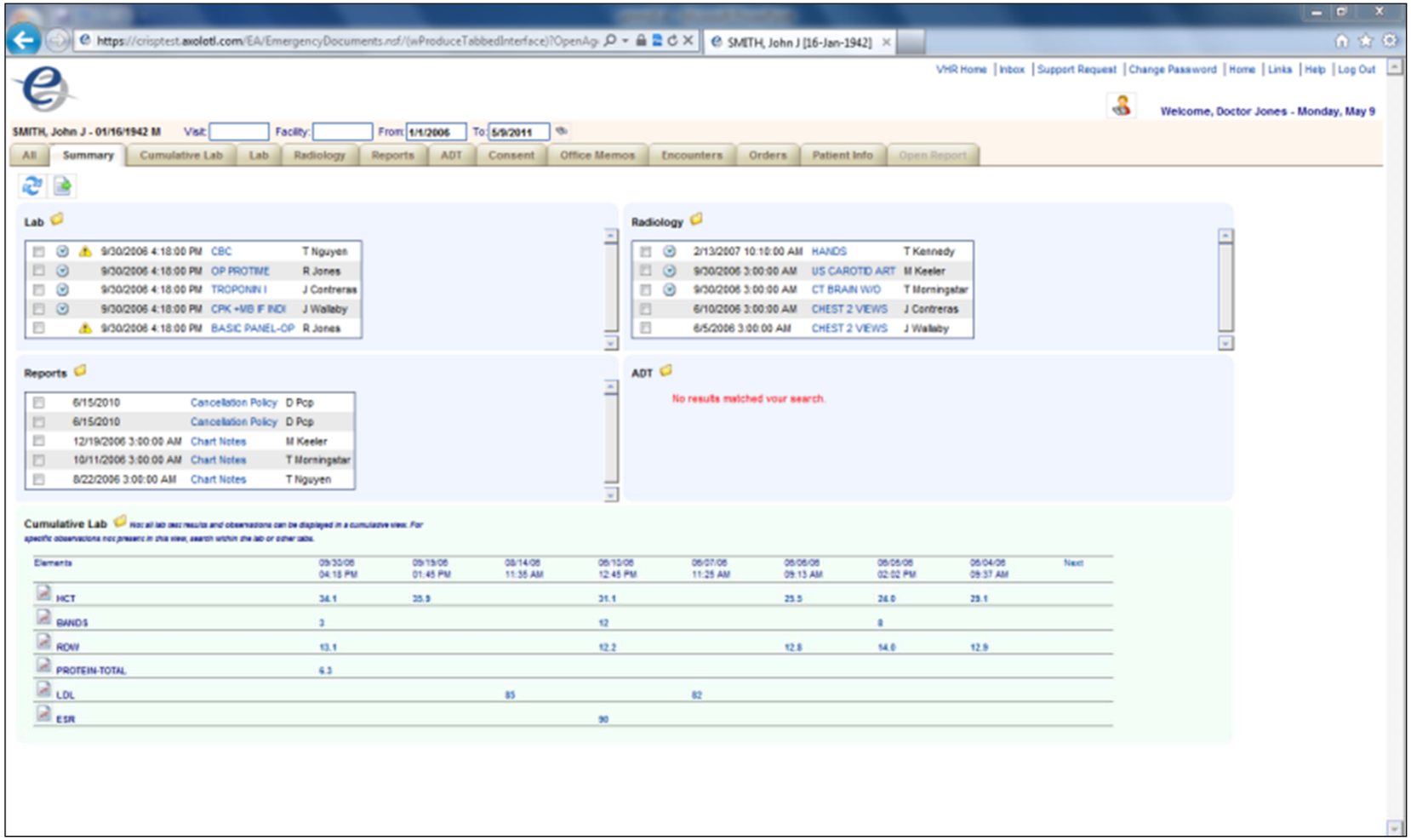
HIE Examples → CRISP *(cont.)* →Query Portal



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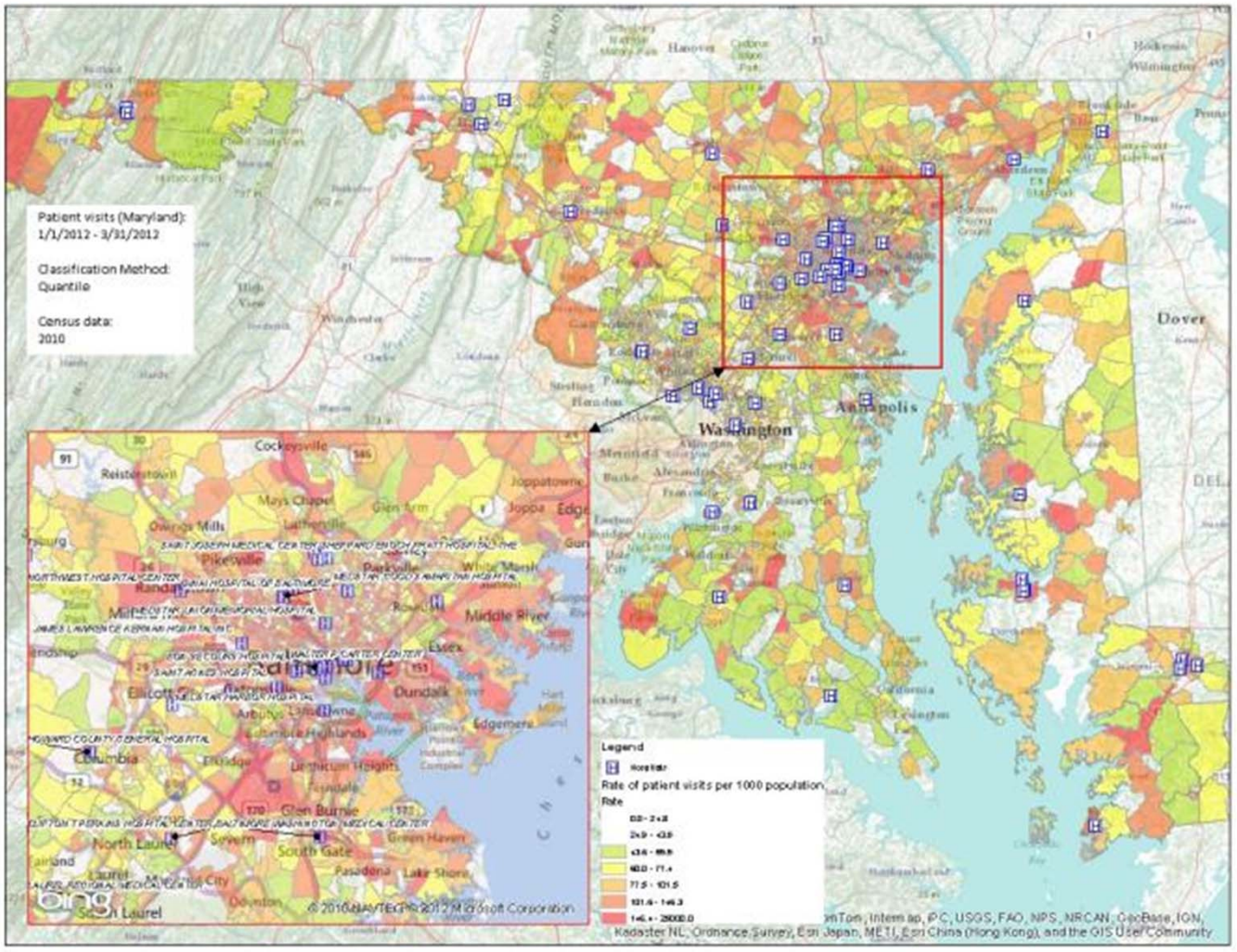
HIE Examples > CRISP *(cont.)* →Encounter Reporting System (ERS)



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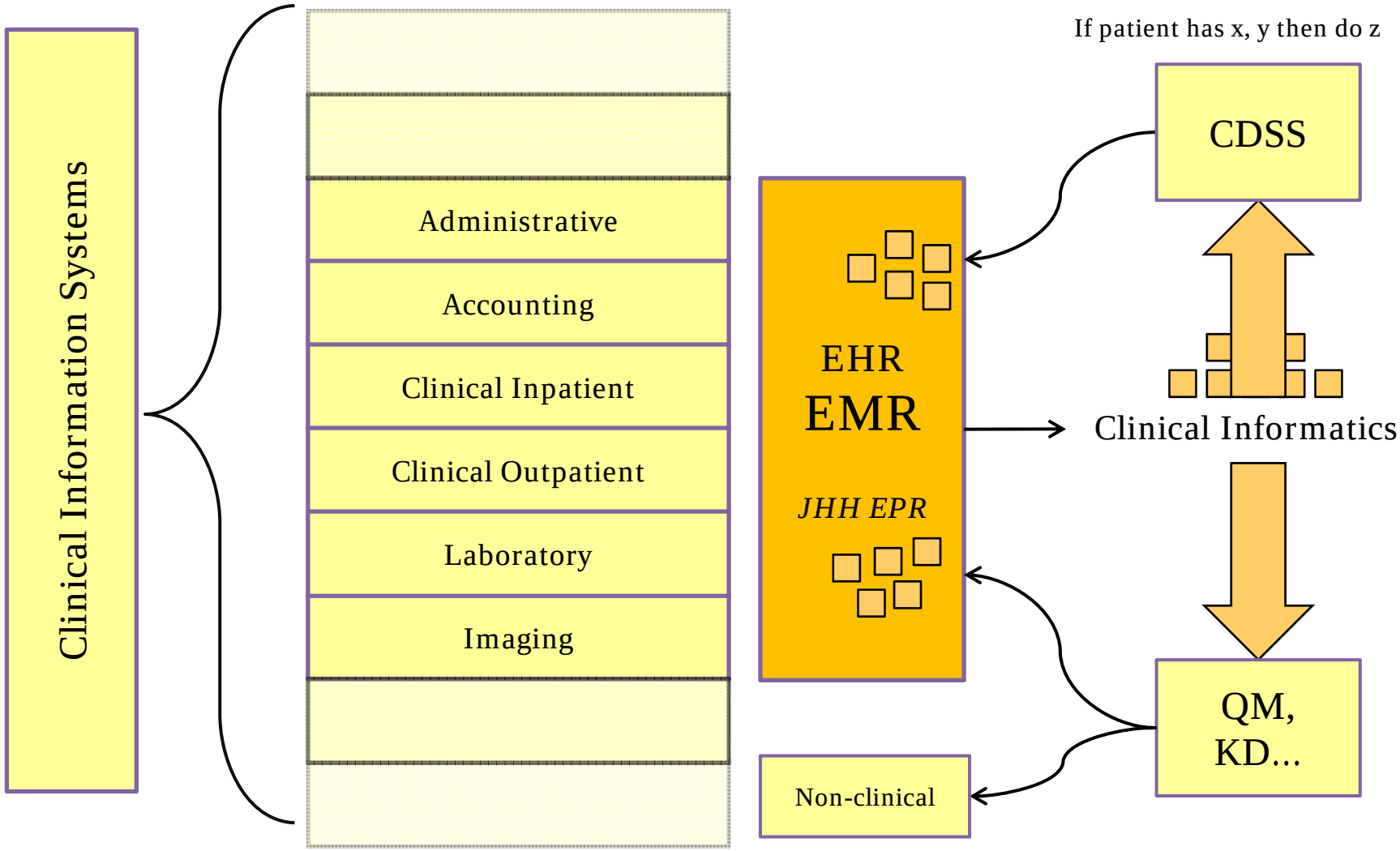
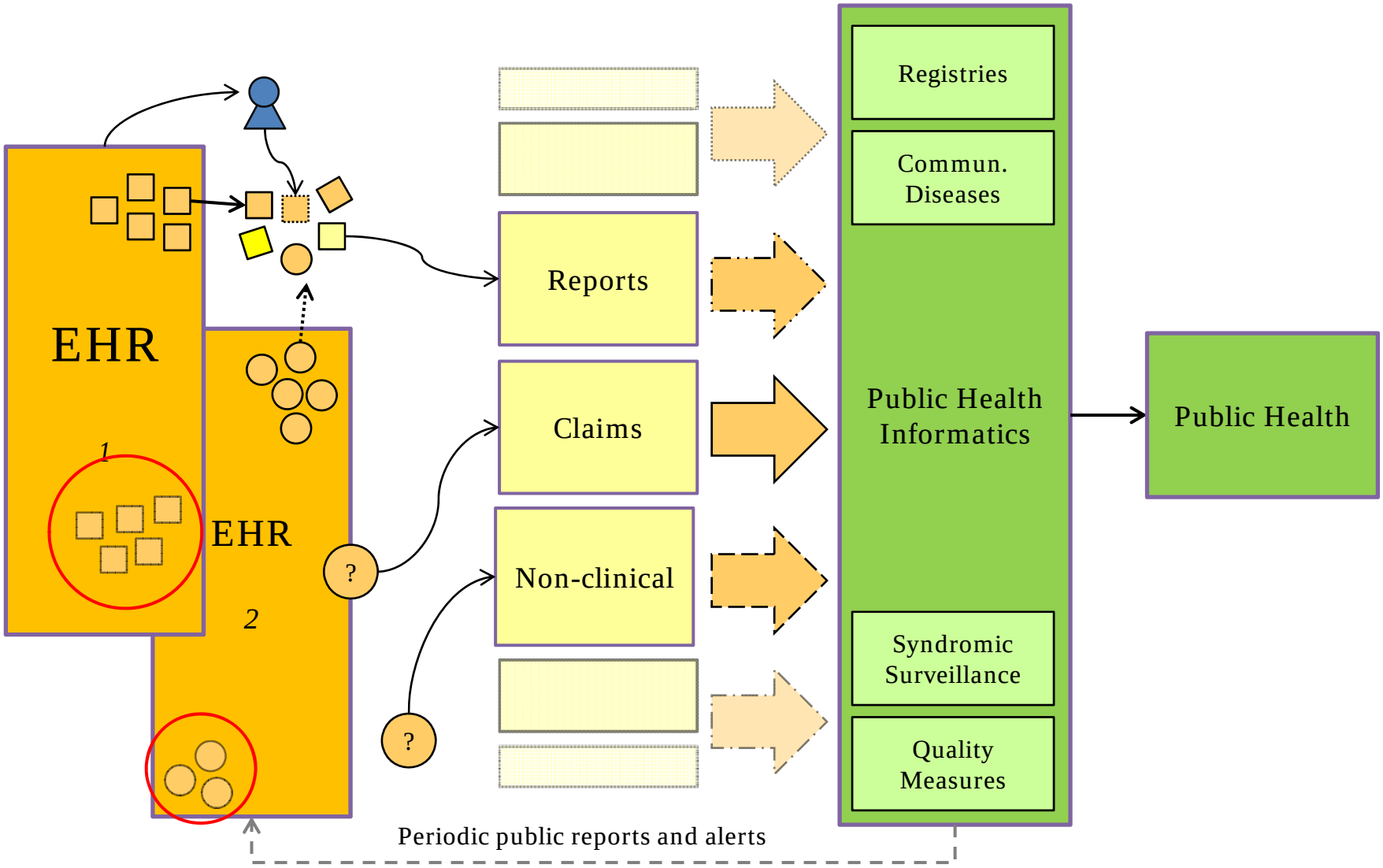
HIE and Population Health IT

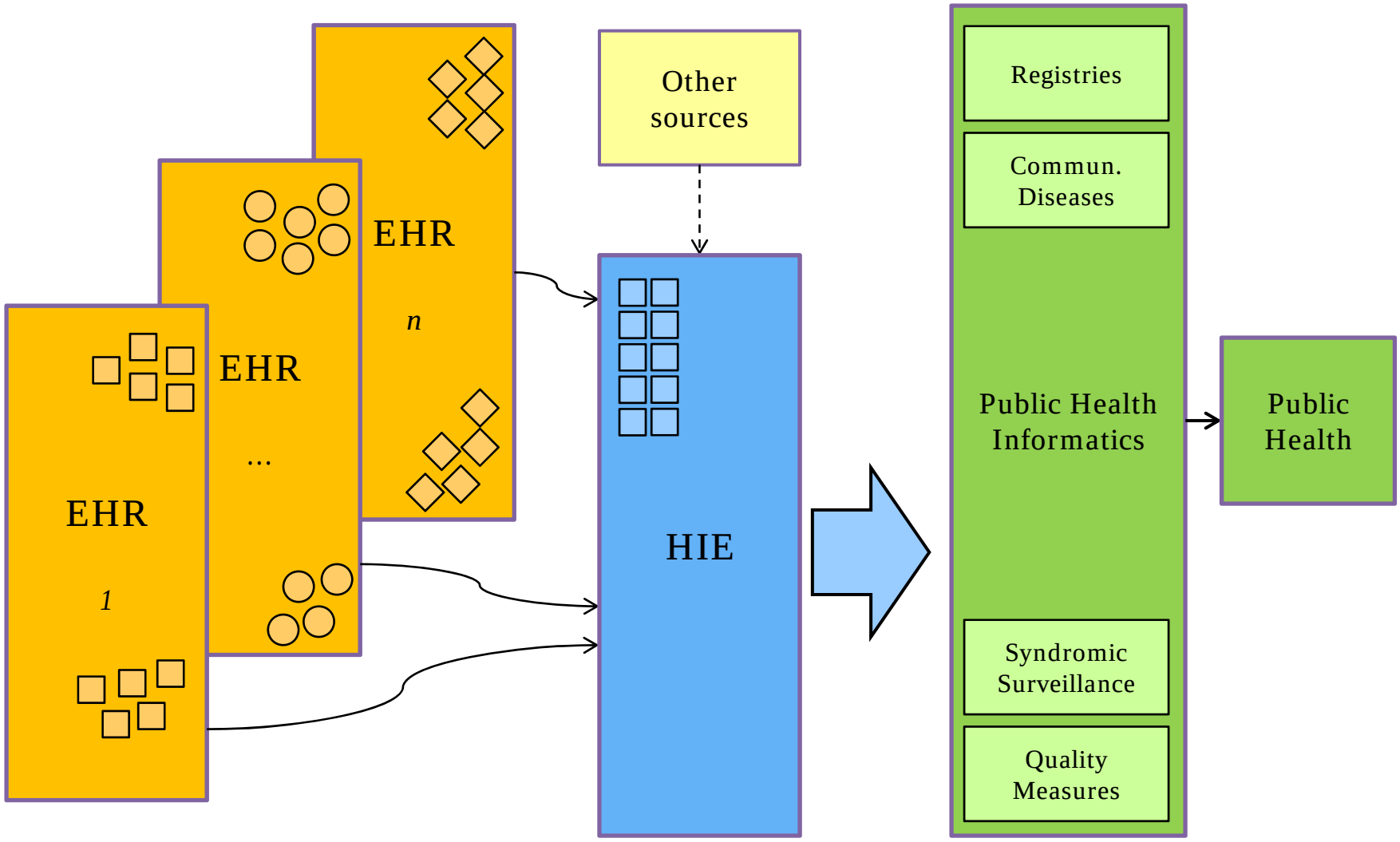
HIE and Population HIT → Clinical Informatics



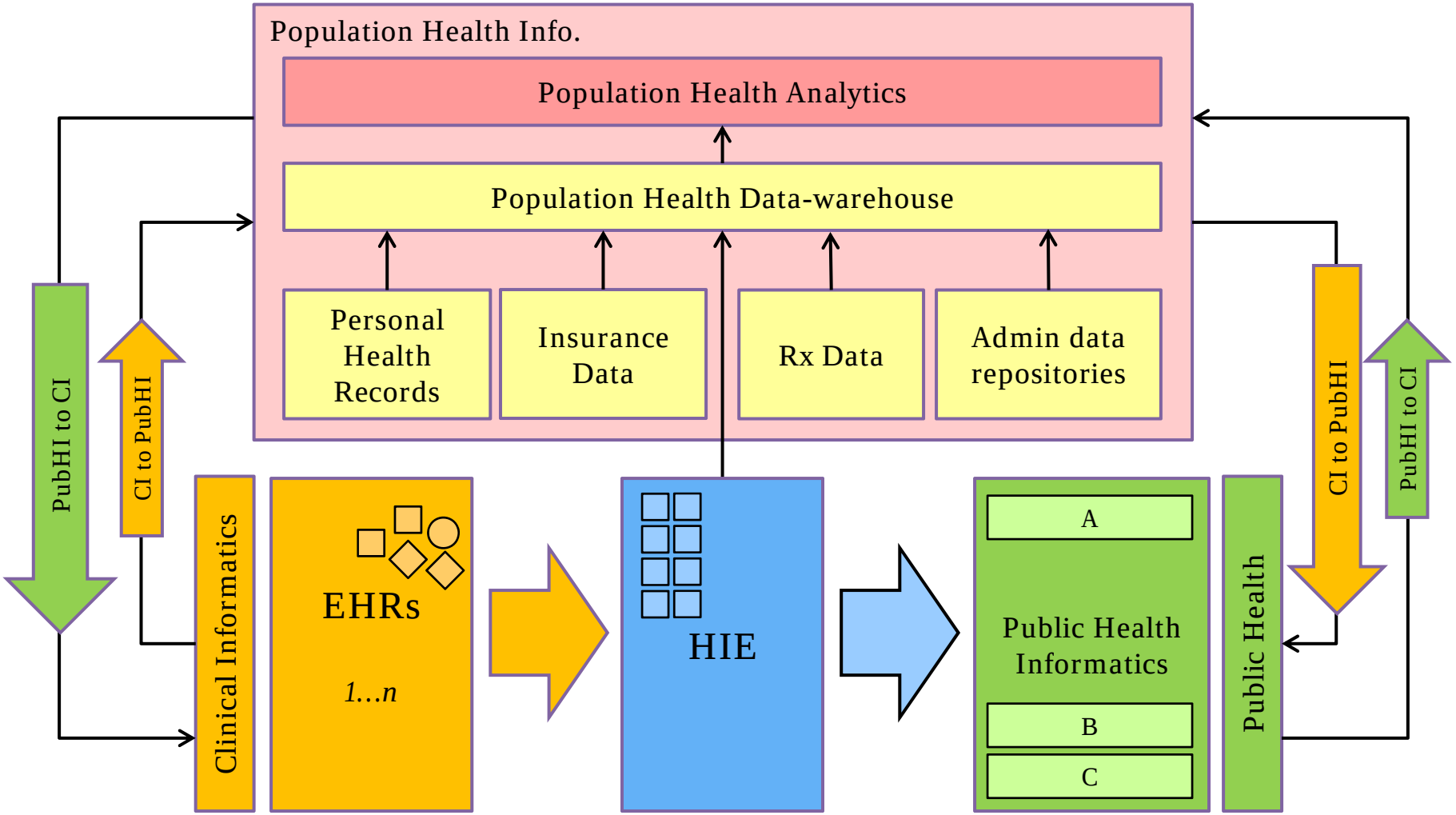
HIE and Population HIT → Public Health Informatics



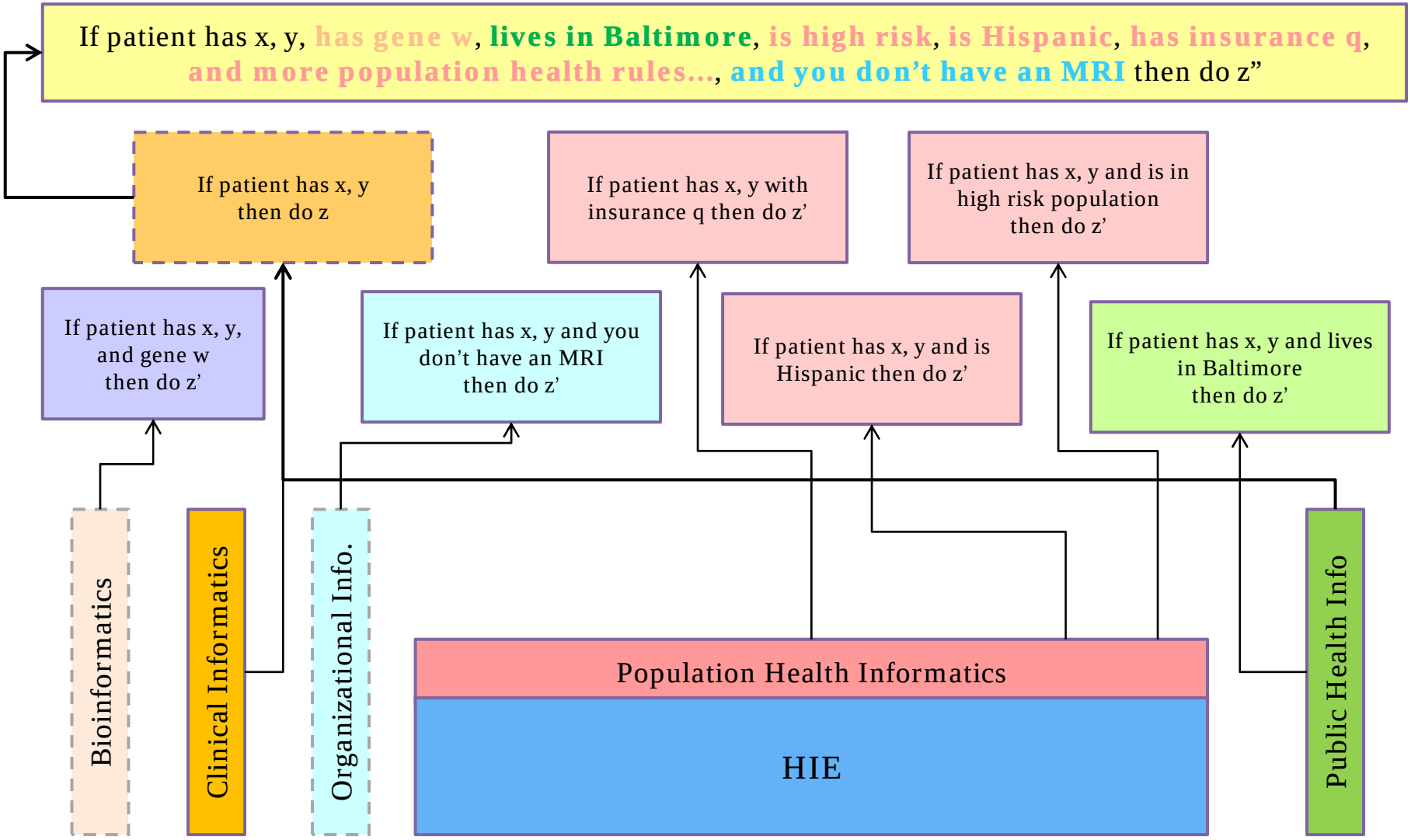
HIE and Population HIT → HIE Role



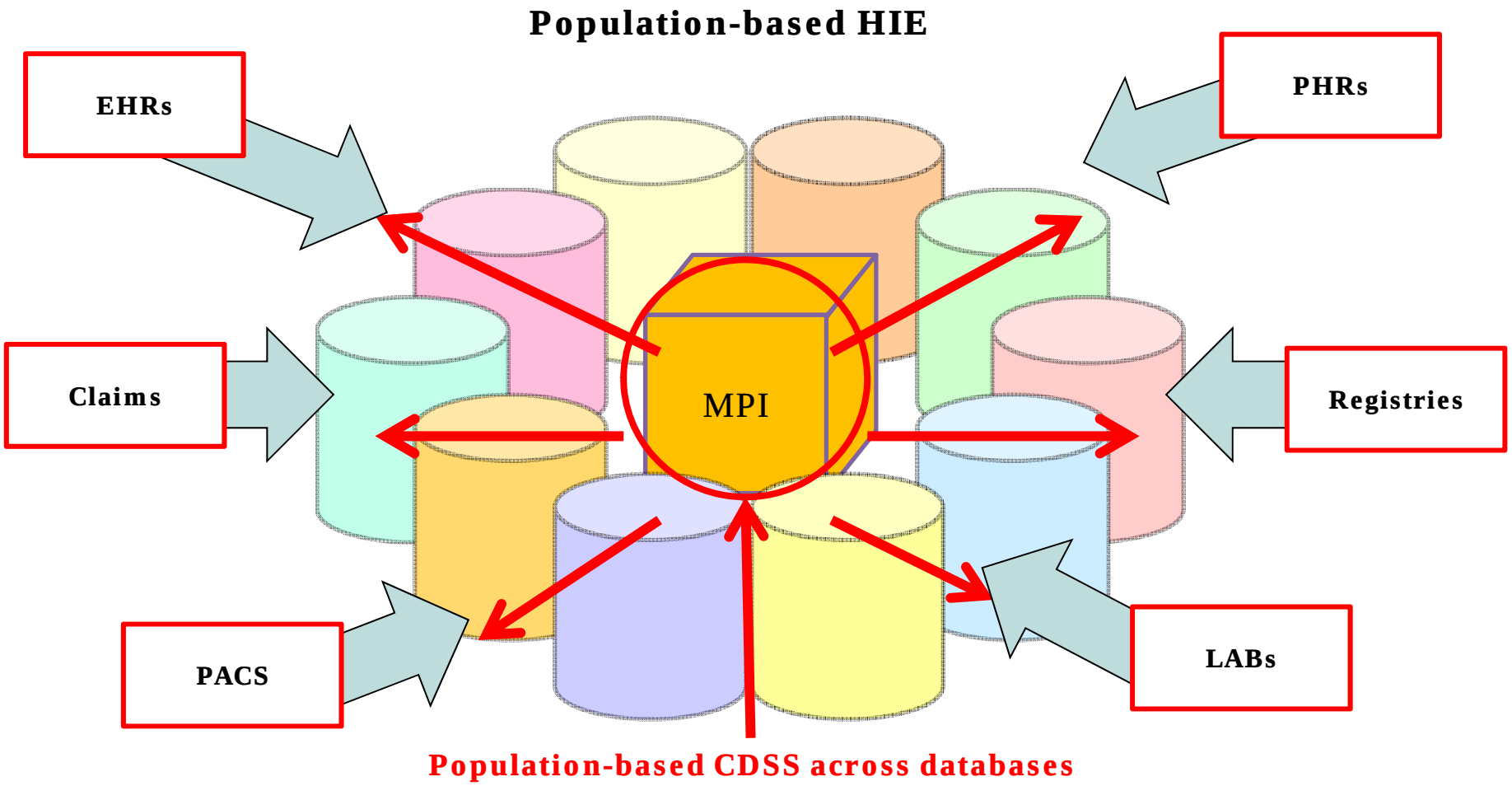
HIE and Population HIT → Population Health Informatics



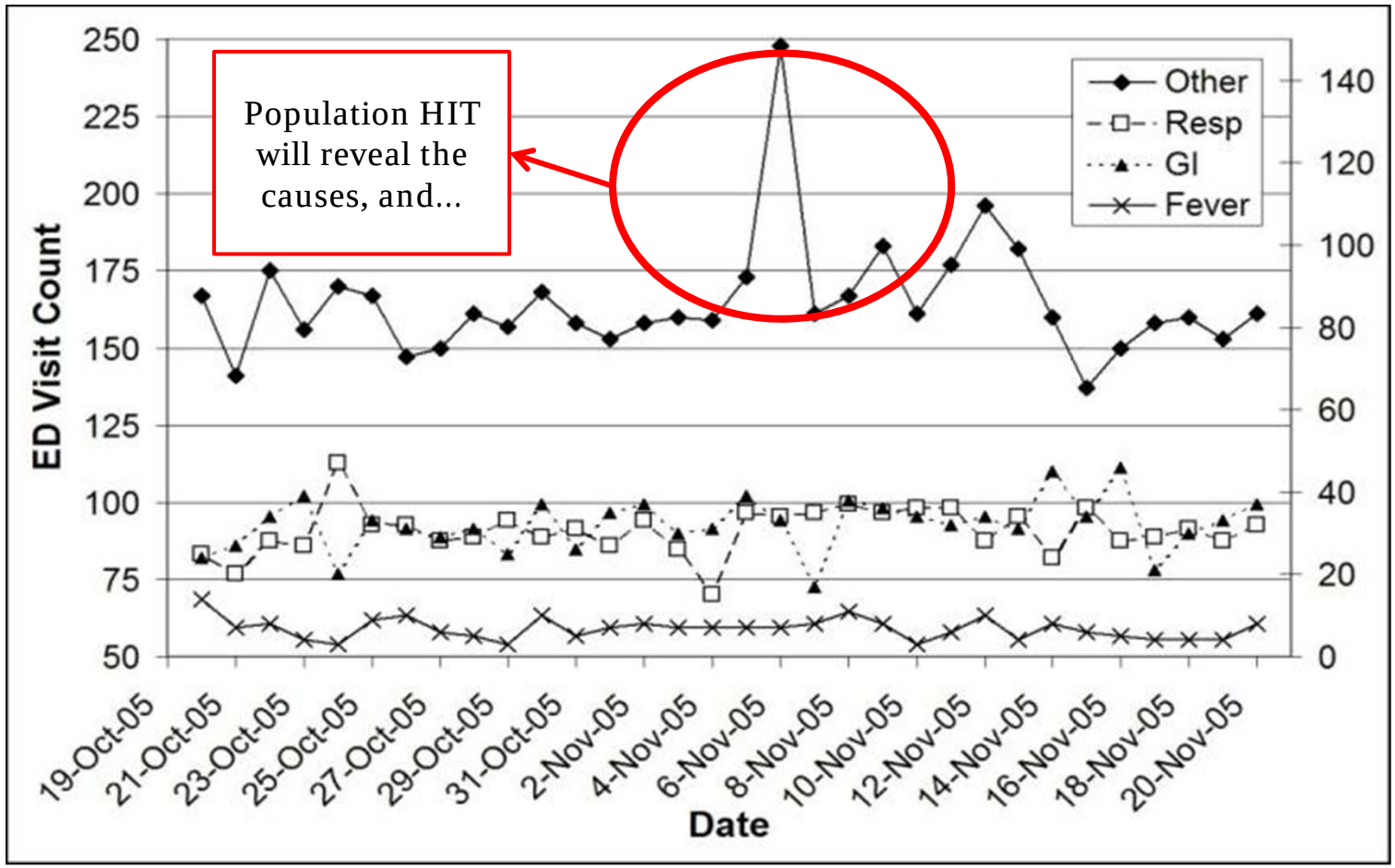
HIE and Population HIT → Clinical Decision Support (CDS) Continuum



HIE and Population HIT → CDS Continuum *(cont.)*



HIE and Population HIT → CDS Continuum *(cont.)*



Simple statistics based on numerical statistics

Consider the potentials with Population-based CDSS integration

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HIE Future

HIE Future

- HIE will "happen" but will seldom follow the script.
- Established entities that can provide services "on the margin" will have a competitive advantage.
- The primary barrier to competitor entry is trust.
- Many geographic HIOs will become highly-valued CHINS (version 2.0).
- Under certain payment models, providers who fail to collaborate will be at a competitive disadvantage.
- Policy may not keep up with the pace of information use; enforcement of detailed policy is problematic.
- The role of innovation is an important component in shaping the future of HIE such as "Beacon" communities.
- The complexity of the U.S. healthcare ecosystem may hinder some of the anticipated efforts to connect a variety of stakeholders.
- Standards will continue to evolve and each HIE must be resilient

HIE Future *(cont.)*

- **Cost**: High infrastructure costs may accelerate merging of HIEs or truncating plans for a variety of HIEs in a state.
- **Political Environment**: Given the current national debt and concerns about funding existing programs, future federal funding may be compromised in the future.
- **Sustainability**: Long-term sustainability will remain a challenge for some HIEs, especially if they must support all costs, potentially without federal funds.
- **Emerging Services**: Can each HIE develop additional services that are emerging in a timely, cost-effective manner, as well as secure the level of adoption required to sustain emerging services?

HIE Future *(cont.)*

- **Business Drivers**:
  - Sustainability; Adoption; Improved Care; Coordination of Care; Decreased Health Costs
- **Industry Drivers**
  - New models: ACOs, Care Coordination, Patient-centered Medical Homes
  - Need to access patient information across various healthcare organizations
  - Requirement to facilitate coordination of care
  - Maintain and access metrics to show outcomes of patient care
  - Leverage electronic transmission of data to payers / insurers
  - Need to automate with EHRs to capture more data
  - Engage consumers with services to accelerate services such as scheduling, physician communication, request for records, etc.

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Additional Resources

Resources → Books (upcoming)

Title	Health Information Exchange: Navigating and Managing a Network of Health Information Systems
Authors	Brian Dixon
Year	2016?
Hardcover	?
Publisher	Elsevier
Language	English
ISBN	Pending...

Resources → Web

- **Associations**:
  - AMIA (American Medical Information Association): www.amia.org
  - IMIA (International Medical Information Association): www.imia-medinfo.org
  - HIMSS (Healthcare Information and Management Systems Society): www.himss.org
  - Academy Health (HIT Interest Group): www.academyhealth.org
- **Government and Non-for-profit**:
  - ONC: www.healthit.gov
  - CMS MU: www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms
  - HL7: hl7.org
  - NLM: https://www.nlm.nih.gov
- **Journals**:
  - JAMIA (Journal of AMIA): jamia.bmj.com
  - JMIR (Journal of Medical Internet Research): www.jmir.org
  - IJMI (International Journal of Medical Informatics): www.ijmijournal.com
  - HIJ (Health Informatics Journal): jhi.sagepub.com
  - ACI (Applied Clinical Informatics): aci.schattauer.de

Summary

- Introduction
- History of HIE
  - *CHIN, CHMIS, SBCCDE, EDI, ONC, NeHC, SI.Framework, HISPC, NHII/NwHIN, HIO*
- HIE Architecture
- HIE Services
- HIE Sustainability
  - *Federal (HITECH) Impact*
  - *States Impact*
- HIE Examples
  - *Indiana HIE*
  - *CRISP*
- HIE and Population Health IT
- HIE Future
- Summary