



Clinical Decision Support for Immunization (CDSi)

Noam H. Arzt, PhD, FHIMSS
HLN Consulting, LLC

American Immunization Registry Association (AIRA)
Regional Meeting
Lansing, MI
August 22, 2014



Table of Contents

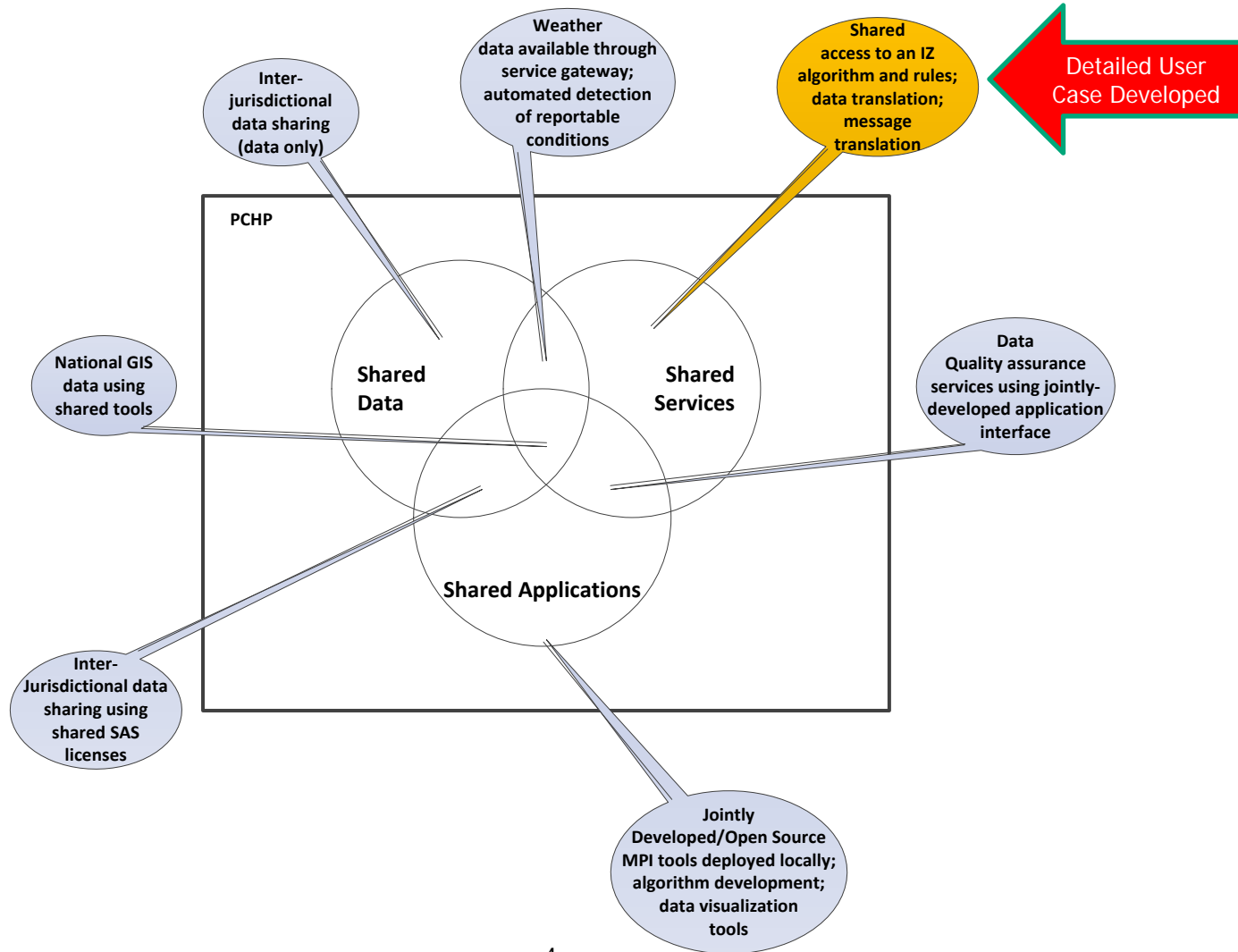
- Review of ASTHO-CDC CDSi Use Case
- Review of CDSi EHR-IIS Functional Overlap
- Discussion throughout:
How do these concepts affect IIS CDSi strategy?



Public Health Community Platform (PHCP)

- Joint ASTHO/CDC Project
- Cloud-based exchange where public health and healthcare are able to develop, compare, and exchange interoperable solutions and allow access to common data sets
- Provide huge improvements in timeliness of information, speed of data gathering and analysis, and efficiency

PHCP (continued)





Use Case Outline

- Overview of PHCP
- Use Case Overview
- Use Case Scope
- Value Statement
- Use Case Assumptions
- Pre-conditions
- Post-conditions
- Actors, Goals, Roles
- Other Stakeholders
- Diagrams
- Usage Narrative
- Trigger
- Main Success Scenario, Extensions
- Frequency of Occurrence
- Policy & Regulation
- Appendix: Proof of Concept



Use Case Overview

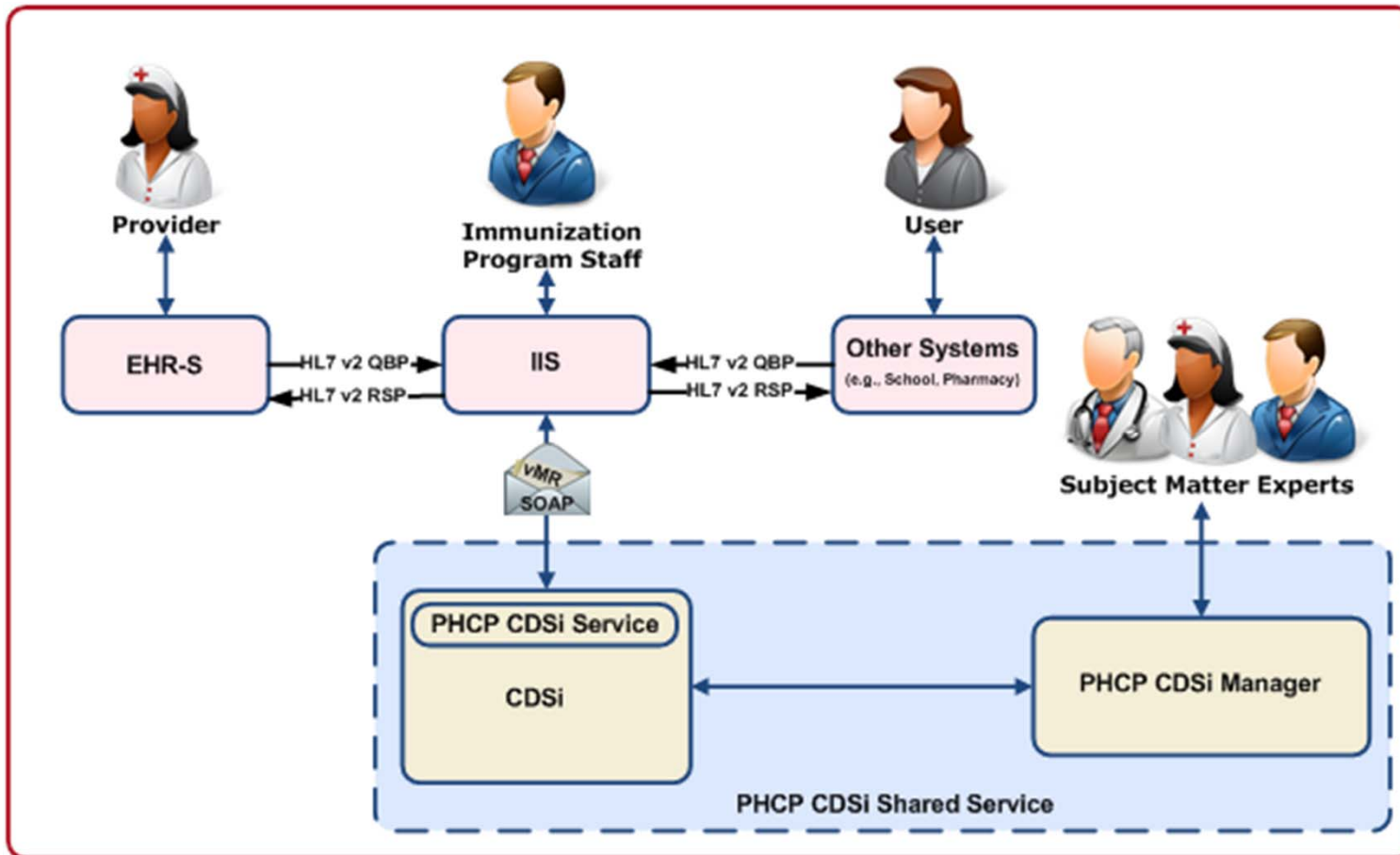
- Growth in number/complexity of immunizations
- CDSi: Evaluation and Forecasting
- IIS: Participation, coverage, CDC Functional Requirements
- Limitations and inconsistencies of many current CDSi implementations
- Goal: Well-designed and broadly adopted CDSi service to improve the consistency of vaccine forecasts across the community



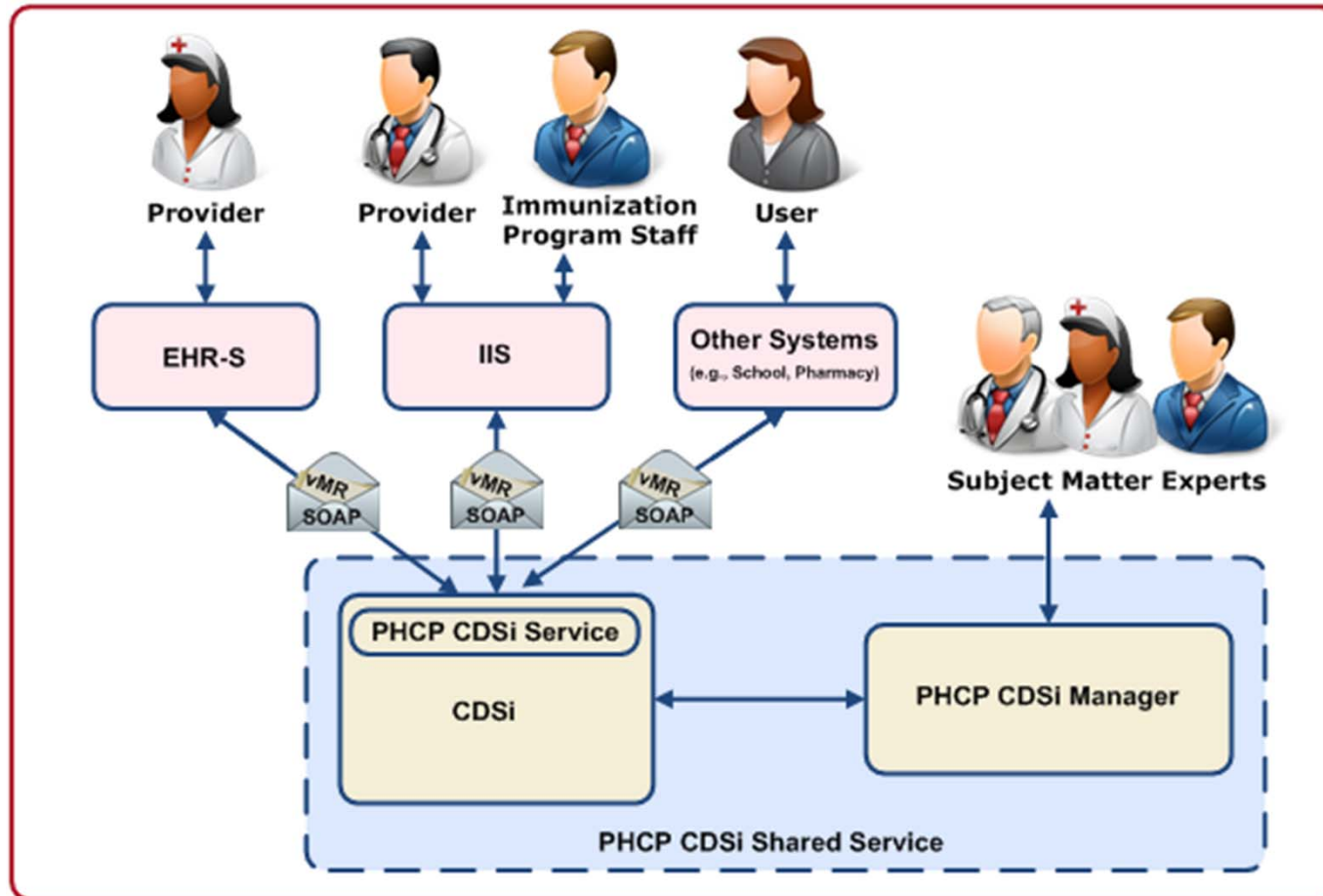
Goals of an Independent CDSi

- The ability to support multiple immunization schedules
- The ability to simultaneously process multiple requests for CDSi
- The implementation of a fully automated testing process
- The creation of graphical user interface (GUI) tools that empower clinically-oriented subject matter experts (SMEs) to update and maintain the immunization schedule without any involvement from programmers, and that supports the automated testing
- That it be a self-contained module that could be deployed in diverse technical environments and accessed by other systems through a standards-based Web Service interface

CDSi Architecture via IIS



CDSi Architecture: Directly





Value Statement

- Developing/maintaining CDSi is hard:
 - Medical/nursing staff
 - Business Analysts
 - Programmers
 - Testers
- Market, financial, technology forces → “Shared Services”
 - Shared service: common platform
 - Shared data: rules and terminology
 - Shared application: replicate software



Assumptions

- The PHCP CDSi Service is installed and configured on PHCP (the exact nature of this platform is not yet determined).
- The PHCP CDSi Manager is installed and configured on the PHCP.
 - The PHCP CDSi Manager is used to specify and maintain the detailed concepts, vaccine series, and rules that drive the PHCP CDSi Service's algorithm.
 - At minimum, the rules defined by the ACIP immunization schedule should be configured. However, multiple immunization schedules are supported.
- The PHCP CDSi Service is available and operating properly.
- The system invoking the CDSi service is authorized to do so, and authenticated for the purposes of maintaining an audit trail of service calls within the CDSi service.
- Patient's immunization record is located in the IIS or EHR-S.
- Neither the IIS nor the EHR-S immunization record may be complete since the patient may have received immunizations that are not yet recorded in either system.
- Only one patient record results from an IIS search.
- System which will invoke the PHCP CDSi Service is capable of structuring a proper message to invoke the service.
- System which will invoke the PHCP CDSi Service can consume the results.

Potential User Organizations

	Self-supported	Assisted	Hosted
IIS Immunization evaluation and forecast is a CDC Core Functional Standard.	Most IIS have the expertise and interest in at least defining their own rules if not managing them.	This might involve an IIS deploying its own Web Service but relying on PHCP to configure it and manage the rules, or offer other ad hoc assistance.	Some IIS are looking for a turnkey solution that involves little effort or expertise on their part.
Other Public Health Agency PHAs might want to use CDSi for data analytics including up-to-date calculations for individual patients and whole populations.	Local/state PHA with strong informatics capability may want to manage a software service and its rules on their own, but these are likely the exception rather than the rule.	This might involve a PHA deploying its own Web Service but relying on PHCP to configure it and manage the rules, or offer other ad hoc assistance.	Most local PHAs likely want a turnkey solution as they do not have the informatics expertise to deploy or maintain a web service.
EHR-S Vendor CDS is a major area of functionality and most general-purpose EHR-S do not do this well, especially when it comes to pediatric functions.	Most EHR-S vendors would likely want to run and maintain their own Web Service.	Some EHR-S vendors may want some level of assistance if they are less confident especially of their medical expertise in this area.	PHCP could offer a fully-hosted service for an EHR-S vendor, but would need to make sure it has the support and technical capacity to maintain it.
Academic Medical Center Many have developed and deployed home-grown EHR-S.	Those with strong informatics programs may just want to do it themselves. They also tend to be familiar with the open source model.	Those with less capable informatics programs may want some level of assistance all the way up to a turnkey service.	
Accountable Care Organizations (ACO)/Patient Centered Medical home (PCMH) ACOs have high expectations placed on them especially for analytics and often little infrastructure to produce results quickly.	Uncertain of how sophisticated any ACOs might be.	ACOs are more likely to need more services rather than fewer.	

Actors (people): Goals, Roles

Actor	Goal(s)	Role
Provider	<ul style="list-style-type: none"> Obtain immunization evaluations and recommendations for clinical decision support. 	<ul style="list-style-type: none"> Requestor of the PHCP CDSi Service (directly or through an IIS). Primary Actor of this use case.
Immunization Program Staff	<ul style="list-style-type: none"> Obtain immunization evaluations and recommendations to facilitate reporting, data analysis, and other Immunization Program functions (e.g., generating coverage reports, generating reminder/recall reports, supplying data or reports to the CDC, etc.). 	<ul style="list-style-type: none"> Requestor of the PHCP CDSi Service.
School Nurse	<ul style="list-style-type: none"> Obtain immunization evaluations and recommendations for clinical decision support. 	<ul style="list-style-type: none"> Requestor of the PHCP CDSi Service (directly or through an IIS).
Pharmacist	<ul style="list-style-type: none"> Obtain immunization evaluations and recommendations for clinical decision support. 	<ul style="list-style-type: none"> Requestor of the PHCP CDSi Service (directly or through an IIS).
Other Third Party Clinical Information System User	<ul style="list-style-type: none"> Obtain immunization evaluations and recommendations for clinical decision support. 	<ul style="list-style-type: none"> Requestor of the PHCP CDSi Service (directly or through an IIS).
Requestor of the PHCP CDSi Service	<ul style="list-style-type: none"> Utilize the PHCP CDSi Service directly or through an IIS to obtain immunization evaluations and recommendations for clinical decision support. 	<ul style="list-style-type: none"> Any of the above listed actors is a Requestor of the PHCP CDSi Service. Table 8-2 notes Actors (Systems) which are Requestors of the PHCP CDSi Service.
Subject Matter Expert (SME)	<ul style="list-style-type: none"> Specify, configure, and maintain the detailed concepts, vaccine series, and rules that drive the PHCP CDSi Service. 	<ul style="list-style-type: none"> User of the PHCP CDSi Manager.
User of the PHCP CDSi Manager	<ul style="list-style-type: none"> Specify, configure, and maintain the detailed concepts, vaccine series, and rules that drive the PHCP CDSi Service. 	<ul style="list-style-type: none"> SME is a User of the PHCP CDSi Manager.
IT Staff	<ul style="list-style-type: none"> Provide PHCP technical support including but not limited to maintaining the PHCP CDSi Service and the PHCP CDSi Manager. 	<ul style="list-style-type: none"> Technical Support

Actors (systems): Goals, Roles

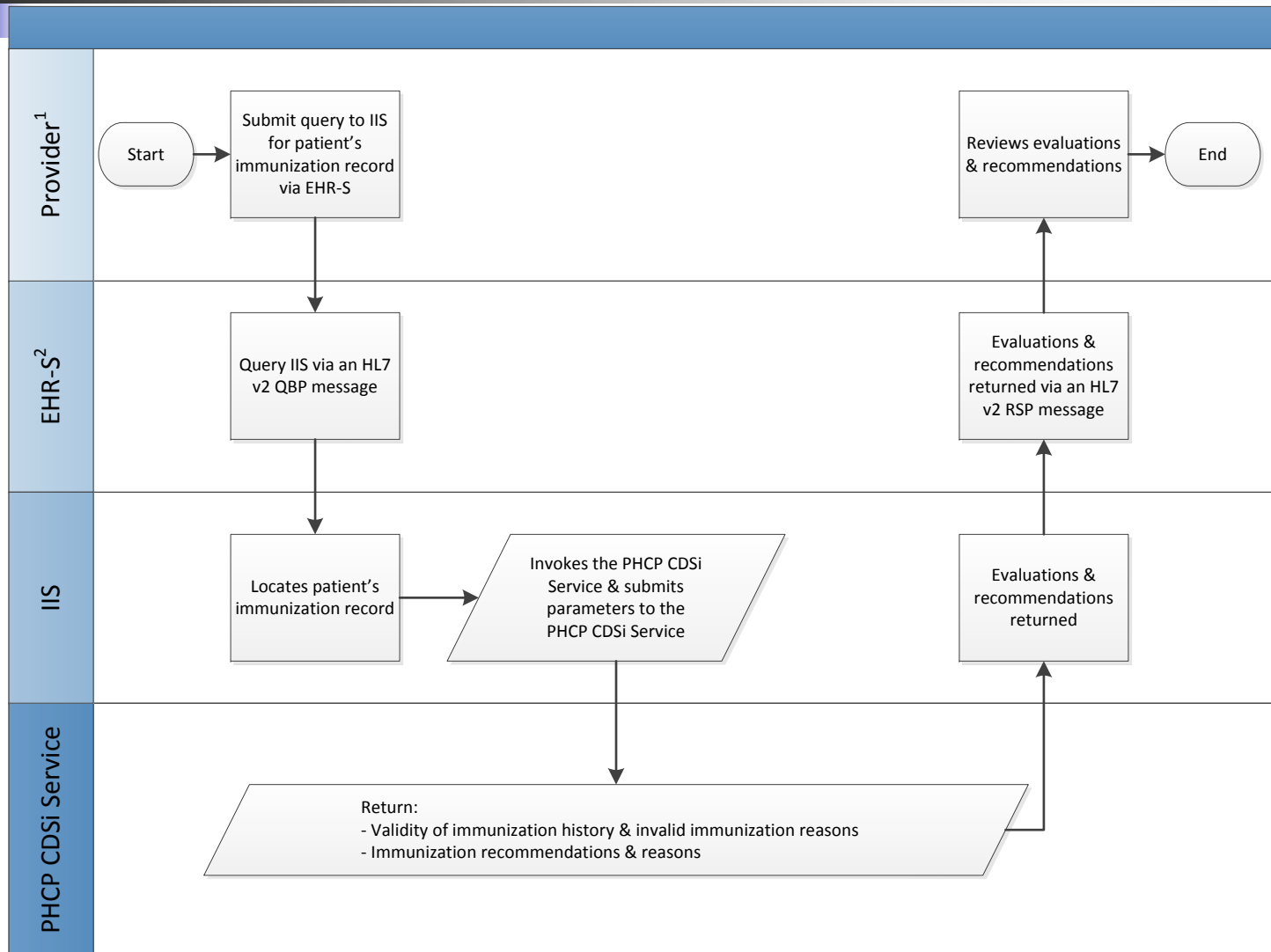
Actor	Goal(s)	Role
IIS	<ul style="list-style-type: none"> Invoke the PHCP CDSi Service to obtain immunization evaluations and recommendations. Provide immunization evaluations and recommendations to the EHR-S if it invoked the PHCP CDSi Service on behalf of the EHR-S. 	<ul style="list-style-type: none"> Requestor of the PHCP CDSi Service. Supplier of the PHCP CDSi Service results to an EHR-S, if services invoked on behalf of the EHR-S.
EHR-S	<ul style="list-style-type: none"> Invoke the PHCP CDSi Service to obtain immunization evaluations and recommendations. Queries IIS for immunization history and forecast. 	<ul style="list-style-type: none"> Requestor of the PHCP CDSi Service (directly or through an IIS).
School Health System	<ul style="list-style-type: none"> Invoke the PHCP CDSi Service to obtain immunization evaluations and recommendations. Queries IIS for immunization history and forecast. 	<ul style="list-style-type: none"> Requestor of the PHCP CDSi Service (directly or through an IIS).
Pharmacy Information System	<ul style="list-style-type: none"> Invoke the PHCP CDSi Service to obtain immunization evaluations and recommendations. Queries IIS for immunization history and forecast. 	<ul style="list-style-type: none"> Requestor of the PHCP CDSi Service (directly or through an IIS).
Other Third Party Clinical Information System	<ul style="list-style-type: none"> Utilize the PHCP CDSi Service directly or through an IIS to obtain immunization evaluations and recommendations for clinical decision support. 	<ul style="list-style-type: none"> Any third party clinical information system able to integrate with the PHCP CDSi Service.
PHCP	<ul style="list-style-type: none"> Provide shared services (e.g., the PHCP CDSi Service and the PHCP CDSi Manager), shared applications for analysis, and access to common data sets. 	<ul style="list-style-type: none"> Platform for shared services, shared applications, and shared data.
PHCP CDSi Service	<ul style="list-style-type: none"> Provide immunizations evaluations and recommendations. 	<ul style="list-style-type: none"> Shared service of the PHCP.
PHCP CDSi Manager	<ul style="list-style-type: none"> Provide mechanism to specify and maintain the detailed concepts, vaccine series, and rules that drive the PHCP CDSi Service. 	<ul style="list-style-type: none"> Shared service of the PHCP.



Other Stakeholders

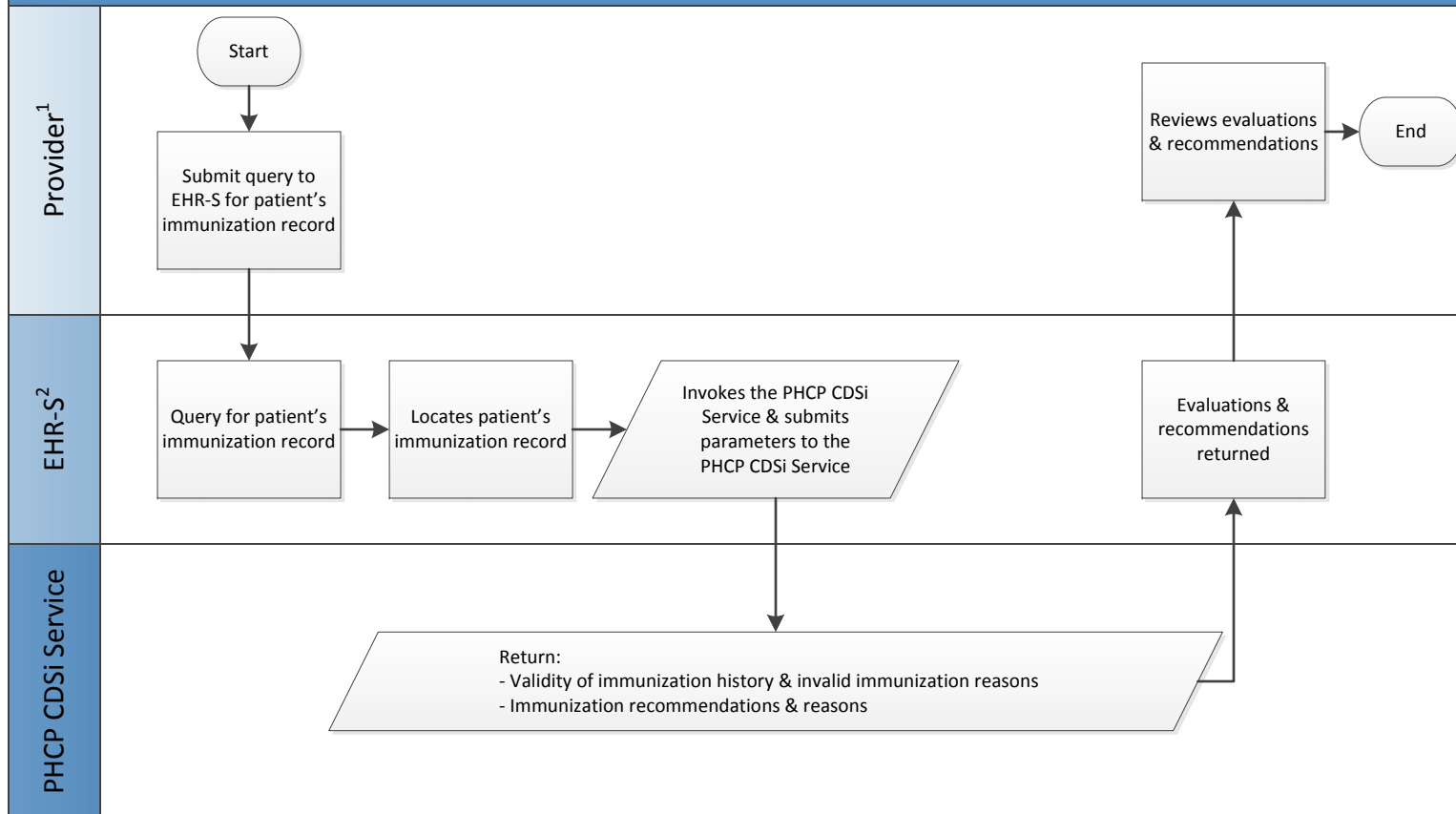
- State or Local Immunization Program
- Provider Organization
- Public Immunization Clinic
- State or Local Health Department
- CDC
- WIC
- Hospital

Main Success Scenario



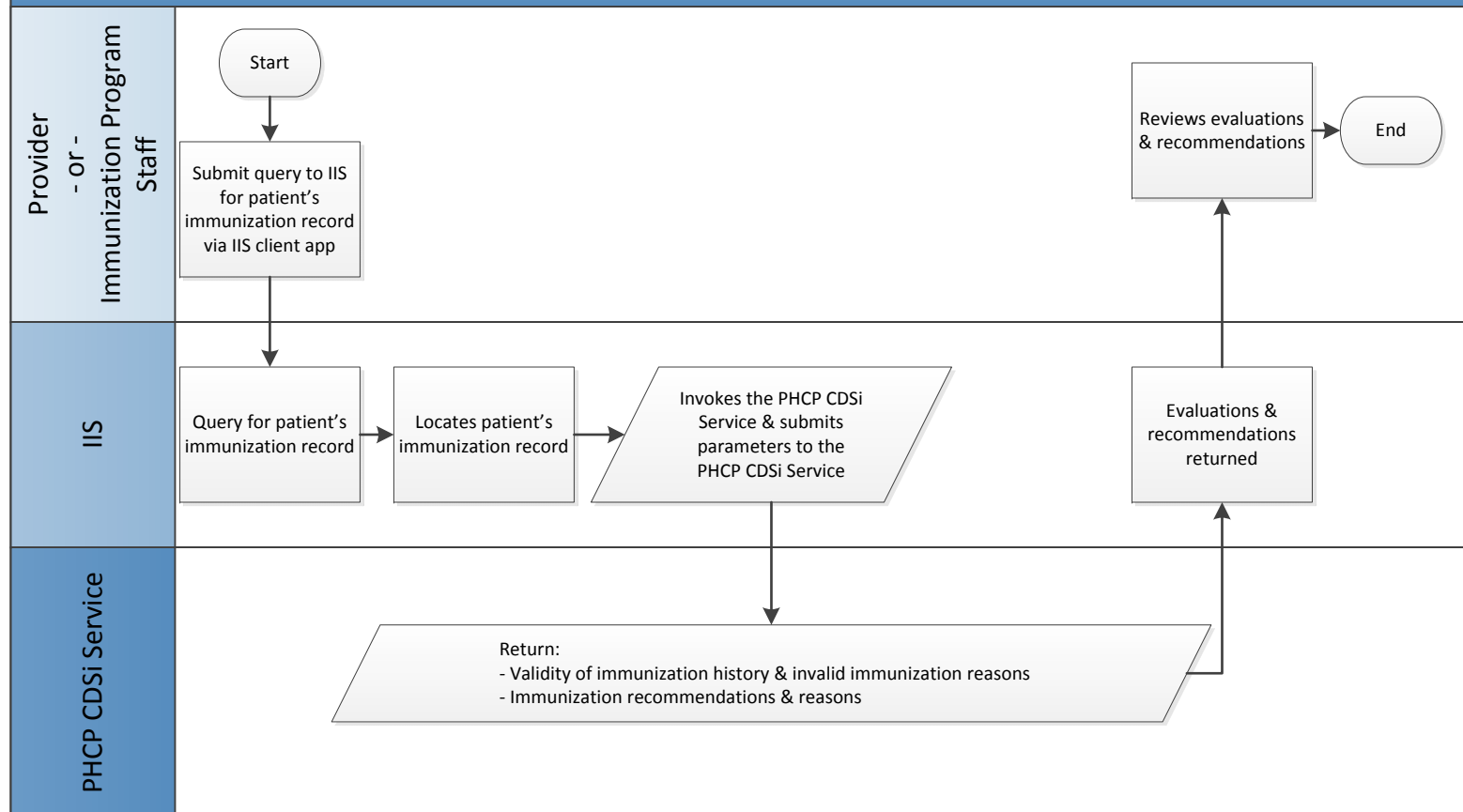
Extension: EHR-S Query

CDSi – Extension (EHR-S Directly Accesses the PHCP CDSi Service)



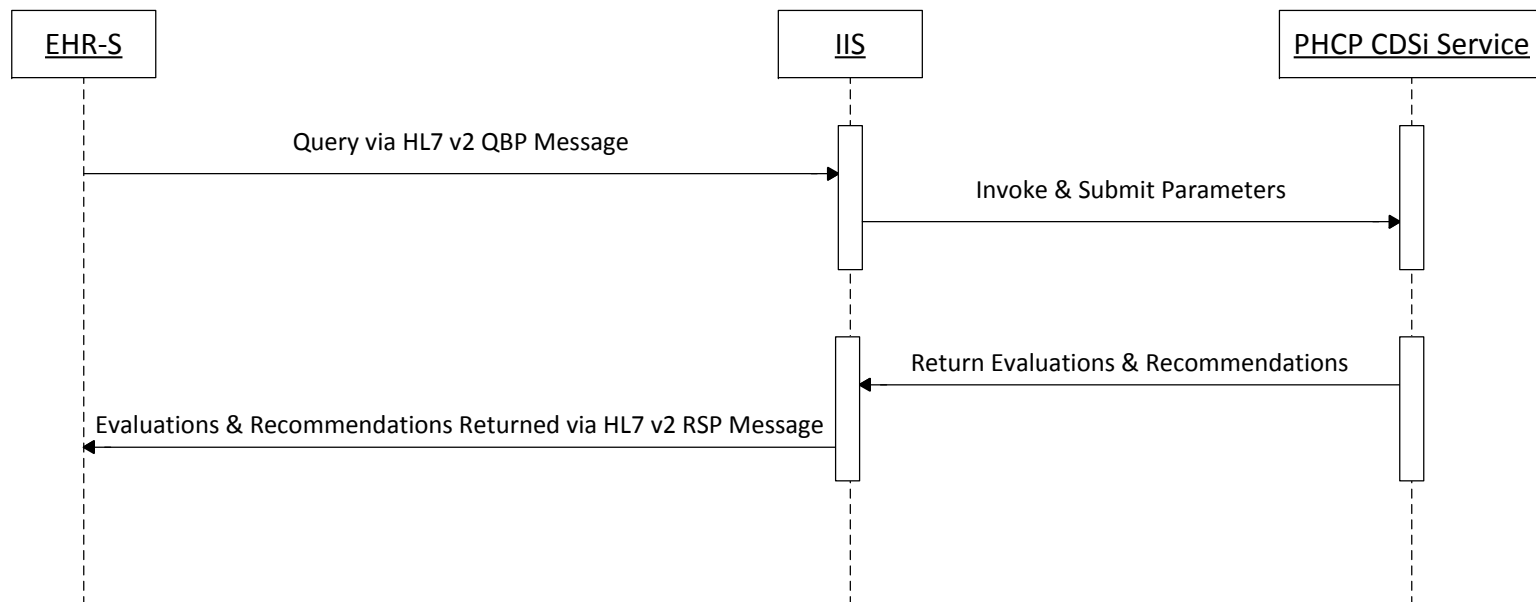
Extension: IIS Client App Query

CDSi – Extension (Query Submitted to IIS via IIS Client Application)



Sequence Diagram (Main)

CDSi – Main Success Scenario (EHR-S Accesses the PHCP CDSi Service through an IIS)





Use Narrative

Mary Mommy brings her 5 year old son Jack to Dr. Wellness, his pediatrician, for his annual physical examination. Mary also needs to register Jack for kindergarten for the upcoming school year and brings the school registration forms to the pediatrician's office to fill out. Mary knows that Jack needs to have all the required immunizations before entrance into school.

During Jack's visit, Dr. Wellness uses the office's EHR-S to issue an HL7 v2 QBP (Query by Parameter) message to query for Jack's immunization record in the State's web-based IIS. After the IIS locates Jack's immunization record, it invokes the PHCP CDSi Service, which evaluates and provides the validity of each immunization in Jack's immunization history as well as provides a recommendation for each vaccine group (*e.g.*, the date on which the next dose is due, series completed, etc.). The IIS returns this information to the office's EHR-S via an HL7 v2 RSP message. Based on the evaluations and recommendations provided by the PHCP CDSi Service which are now displayed in the EHR-S, Dr. Wellness sees that Jack is up-to-date on all his immunizations with the exception of MMR, for which he is due. Jack's first dose of MMR was administered when he was 1 year old.

Dr. Wellness administers the MMR vaccine to Jack and records the vaccine given, the administration date, and lot number in the EHR-S which subsequently submits that immunization to the IIS via an HL7 v2 VXU (Unsolicited Vaccination Update) message. Jack's immunization record is refreshed in the EHR-S through another HL7 v2 QBP message to query for Jack's immunization record. Again, the IIS locates Jack's immunization record, invokes the PHCP CDSi Service, and re-evaluates and provides the validity of the immunizations in Jack's immunization history, including the immunization that was just reported, and provides a recommendation for each vaccine group. The IIS returns this information to the office's EHR-S via an HL7 v2 RSP message. Dr. Wellness now sees in the EHR-S that Jack is up-to-date on all his immunizations and has completed the MMR vaccine series.

Dr. Wellness fills out Jack's school registration forms, uses the EHR-S to print out a copy of Jack's immunization history report, which is now populated with the most recent immunization history, and provides the completed forms and immunization history report to Mary Mommy. Now that Jack's annual physical examination has completed, Mary leaves the office knowing Jack has received all the required immunizations necessary for entrance into school and that she has all the appropriate registrations forms, including the immunization history report, completed and ready to provide to Jack's school.

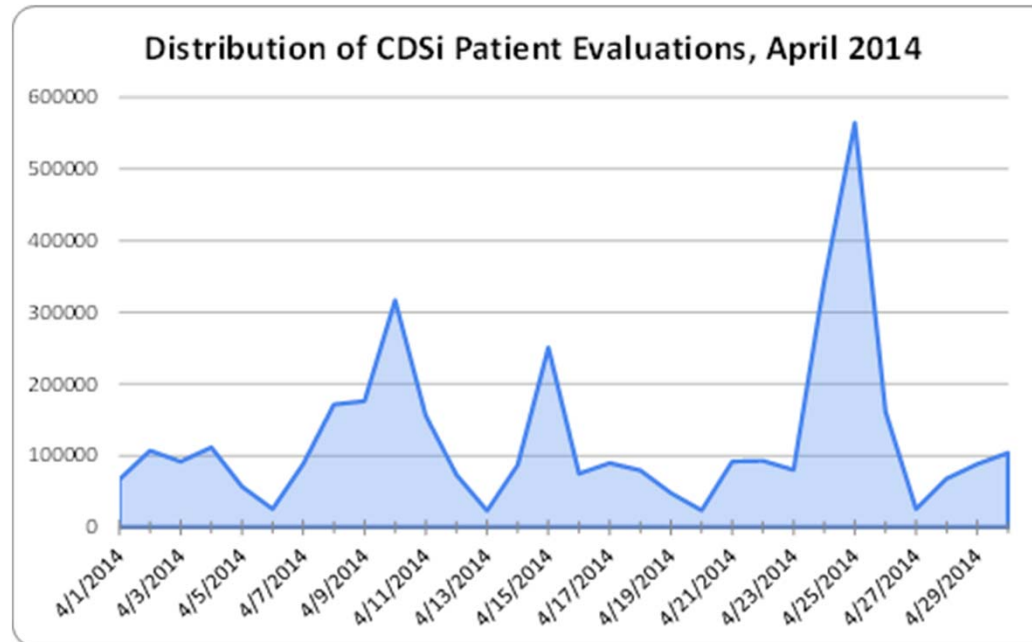


Trigger & Main Success Scenario

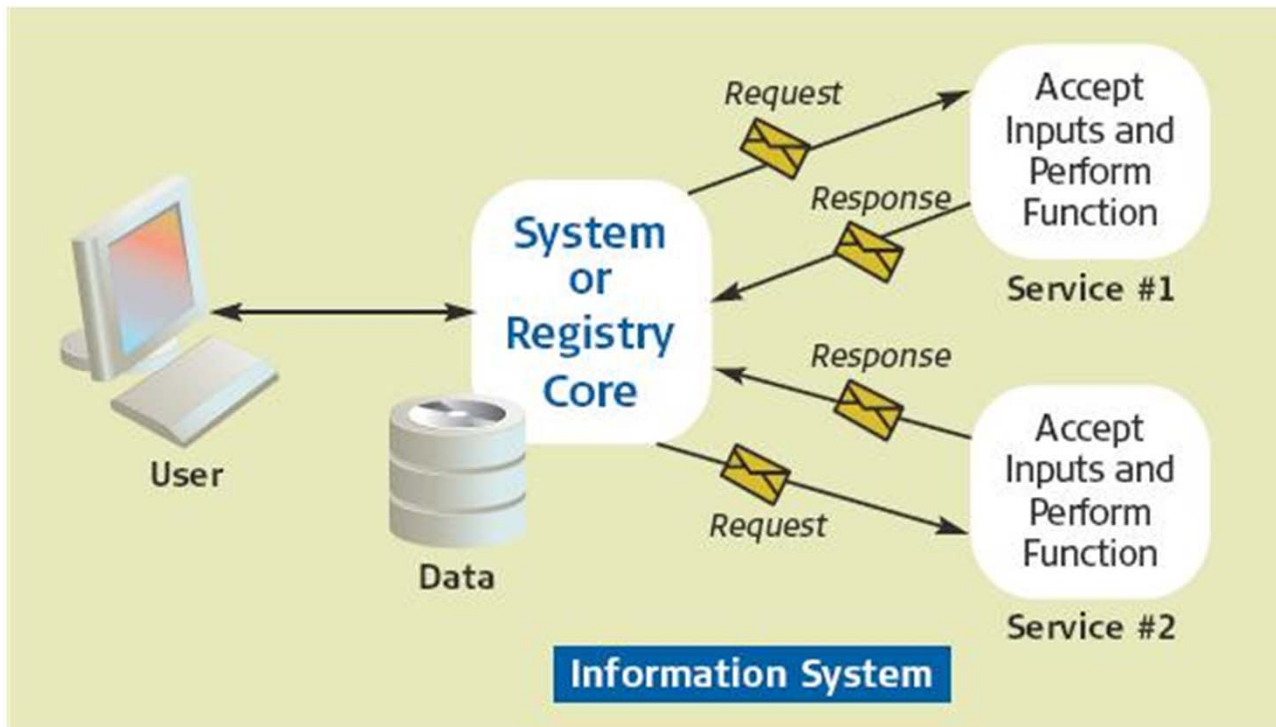
- Trigger: Provider uses an EHR-S to query the IIS for a patient's immunization record
- Steps:
 - Provider using an EHR-S queries the IIS via an HL7 v2 QBP message for a patient's immunization record.
 - IIS locates the patient's immunization record.
 - IIS invokes the PHCP CDSi Service and passes it the following information:
 - Patient's Date of Birth (DOB)
 - Patient's gender
 - Immunization history
 - Immunization schedule identifier
 - Information to support contraindications which may be one or more of the following:
 - Proof of Immunity/Documented Disease
 - Indication that patient has a current illness that would prohibit vaccination
 - History of adverse reaction, vaccine group, and reaction specified
 - List of coded allergies
 - Indication of pregnancy
 - Indication of blood transfusion and blood transfusion component specified
 - Indication that patient is immunocompromised
 - Indication of steroid treatment
 - Indication of uncontrolled or evolving neurologic disorder
 - History of paralysis with Guillain-Barré Syndrome (GBS)
 - Patient status is high risk for a specific disease
 - The PHCP CDSi Service evaluates and returns, to the IIS, the validity of each immunization in the patient's immunization history (*i.e.*, whether each immunization is valid or invalid), and for invalid immunizations, one or more reasons why the immunization is invalid.
 - The PHCP CDSi Service returns, to the IIS, a recommendation (subject to contraindication) for each vaccine group (*e.g.*, the date on which the next dose is due, patient's age on the recommended date, recommendation reason, etc.)
 - IIS returns evaluations and recommendations to the EHR-S via an HL7 v2 RSP message.
 - Provider reconciles the data received from the IIS with the records already stored locally in the EHR-S and reviews the evaluations and recommendations rendered in the EHR-S to facilitate clinical decision making.
- Extensions have variations in the steps

Frequency of Occurrence

- Any time an evaluation and/or recommendations needed, single patient or cohort
- Unique: Changes due to passage of time
- Typical month of NYC CIR evaluations:



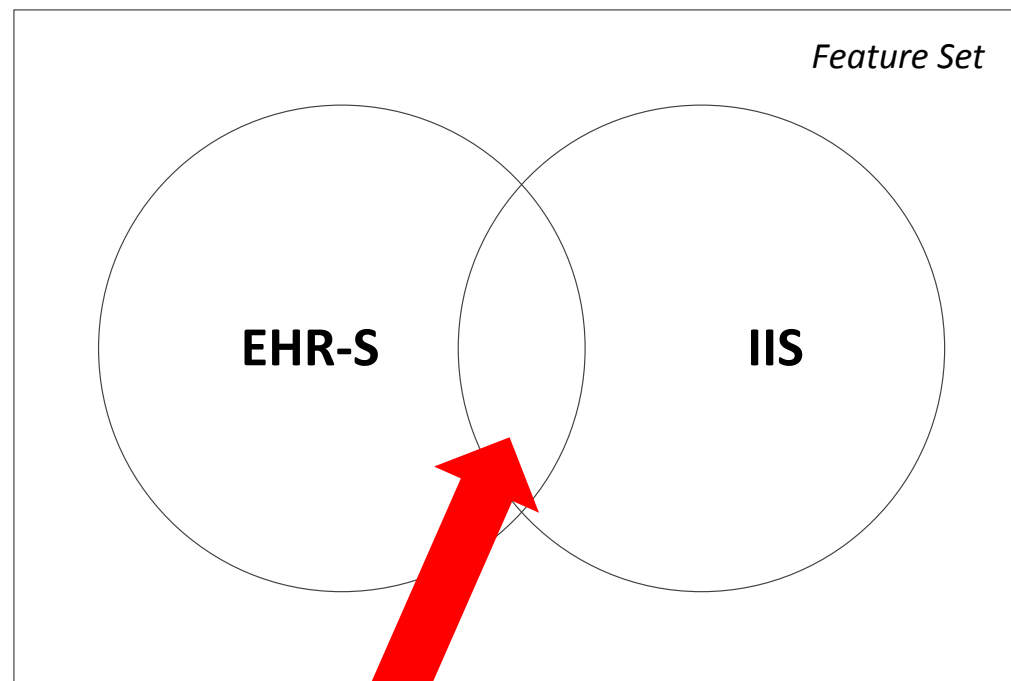
Proof of Concept: SOA



Existing CDSi SOA Products

Category	Description	Example(s)
Proprietary	Existing IIS vendors and developers have already begun de-coupling their algorithms from the rest of the system as a way to improve performance and maintainability, and/or to begin to position the algorithm potentially as a stand-alone product. These components may or may not use a standards-based way of receiving and responding to service calls.	Software Partners' MatchMerge Decision Support Scientific Technologies Corporation's (STC) Stand Alone Forecaster (SAF)
Public Health Developed	Software developed by public health agencies is generally available to other public health agencies by inter-agency agreement or based on the product's source of funding. There has been some sharing of CDSi software between agencies. These components may or may not use a standards-based way of receiving and responding to service calls.	Web Immunization Service Evaluation and Recommendation (WISER), originally developed as part of California Automated Immunization Registry (CAIR) in CA but provided to RI KIDSNET for use as an SOA component there.
Open Source - limited license	Some products – particularly commercially-developed products – are migrating to the Open Source community, but with restrictions as to how they can be used or who can use them. These components may or may not use a standards-based way of receiving and responding to service calls.	STC's Open ImmuCast™ which is only available to public health entities or programs
Open Source – unlimited license	Some products are being developed and managed in the Open Source community with unrestricted licenses for use and modification. These products may or may not come with support from a vendor or organization.	HLN Consulting, LLC's (HLN) Immunization Calculation Engine (ICE), which is built on OpenCDS and uses Health eDecisions (HeD) standards (no commercial software dependencies). Texas Children's Hospital's Open Immunization Software which is supported by Dandelion Software and Research.

IIS and EHR-S Function Overlap



Function Overlap



CDSi within EHR-S

- No real standards
- No uniformity
- Evaluation and forecast only as good as the immunization history that is known
- Generally low priority for development and maintenance (often higher priority among pediatric EHR-S)



EHR-S CDSi Alternatives

- Natively within the EHR-S (see previous slide)
- Natively within the EHR-S via a web service accessed by each EHR-S installation: modularity with control
- Via HL7 query/response with an IIS

Advantages

- Less work for EHR-S vendor
- Query/response likely in MU3
- CDSi would be customized to each jurisdiction by IIS
- Encourages providers to synchronize data with IIS

Limitations

- Some IIS might not be ready
- IIS don't respond to queries in a uniform way
- CDSi rules out of the EHR-S vendor's control



EHR-S CDSi Alternatives (continued)

- Consistent with this Use Case:
 - As a web service provided by the IIS (relies on IIS “rules” but not IIS data)
 - As a web service provided by an independent organization, public or private
- Key issue for an EHR-S vendor: One strategy nationally, or many?



Resources

- HLN IIS White Paper & Presentations:
http://www.hln.com/resources/imm_info.php

- ASTHO Use Case:

Not yet posted by ASTHO but available by e-mailing arzt@hln.com



Contact Information

Noam H. Arzt

President, HLN Consulting, LLC

858-538-2220 (Voice)

858-538-2209 (FAX)

arzt@hln.com

<http://www.hln.com/noam/>