

# **SOA in Healthcare: *Value in a Time of Change***

## **June 2-4, 2009 - Chicago, IL USA**

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### **Status Update on The HL7 Project - EHR System Design Reference Model (EHR-SD RM)**

Wed. 3 Jun 2009, Session 3, 1400 - 1430

Speaker Code: [03-TII-02]

Hyatt Regency O'Hare, 9300 Bryn Mawr Ave., Rosemont, Illinois

<http://www.omg.org/news/meetings/HC-WS/program-d-09.htm>

**Nancy Orvis**, HL7 Project Co-Chair

**Stephen Hufnagel PhD**, HL7 Project Facilitator

# Learning Objective: Understand how to leverage SOA and IER in System Design Reference Model

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**Audience:** Developers and Managers

**Analytic Process:** How to integrate a healthcare system design or acquisition specification, with national standards from HL7, HITSP and CCHIT.

**Benefits:**

- Understanding by both managerial and developers on what is needed to create standards-based EHR interoperability at the Service level.
- Managers can understand SOA designs in order to justify funding.
  - Intuitive understanding of services as automating business functions
  - Consistent requirements, design-specifications and implementations
  - Better costing.

# Agenda

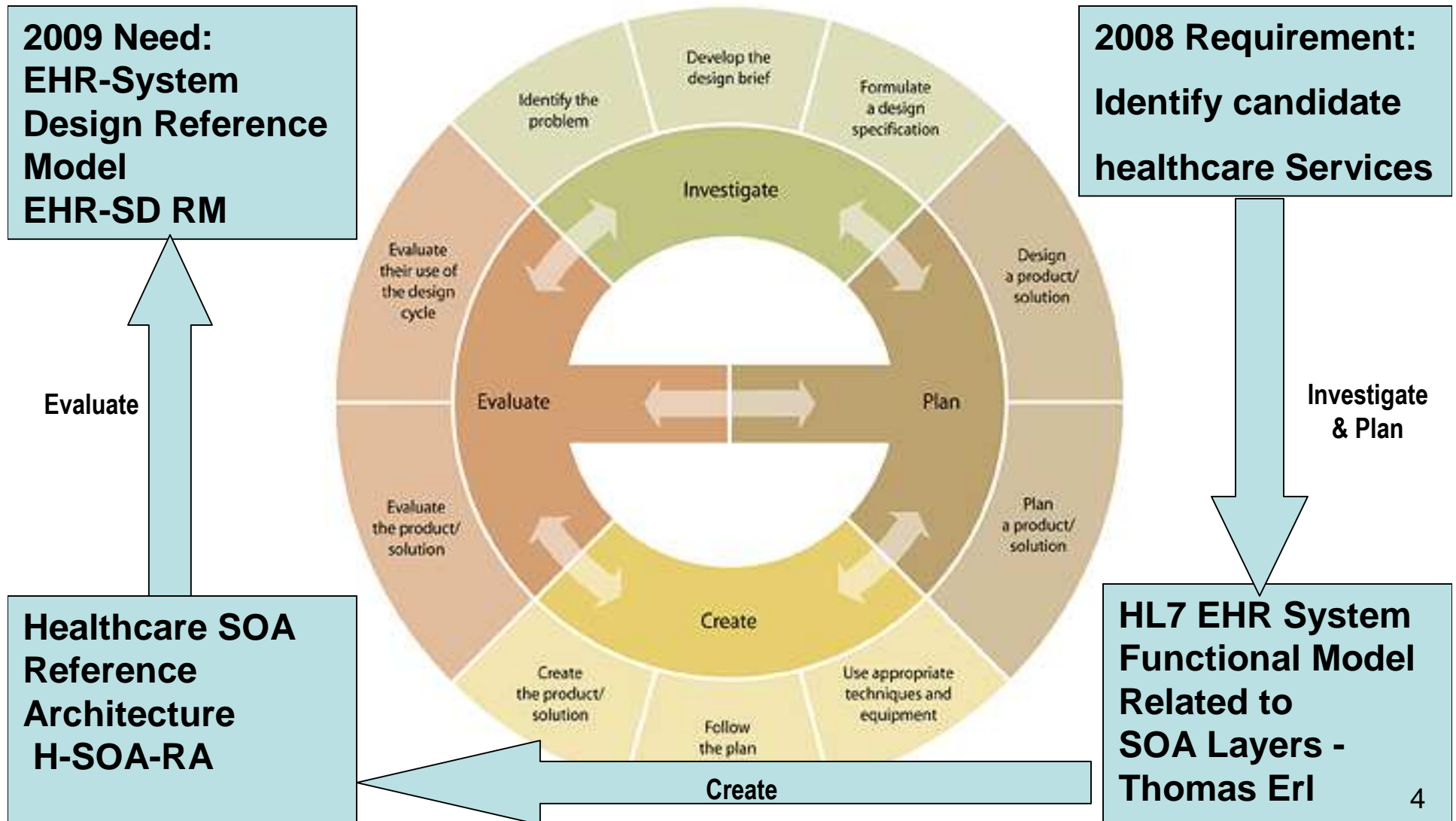
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1. **Review H-SOA Reference Architecture Project deliverables**
2. 2009 HITSP work on Information Exchanges among the Use Cases
3. Building the content of the System Domain RM from HL7, HITSP, DOD components
4. Use Case PHER
5. SD analysis. On PHER

# System Design Lifecycle

## 2008 Healthcare SOA Reference Architecture

### H-SOA-RA



# 2008 Results

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1. Health SOA Reference Architecture - Overall Goal
  1. Service Traceability
  2. EHR System Functional Model (EHR-S)
  3. Healthcare SOA Reference Architecture (**H-SOA-RA**)
  4. Notional Functional Example

# 2008 Healthcare SOA Framework

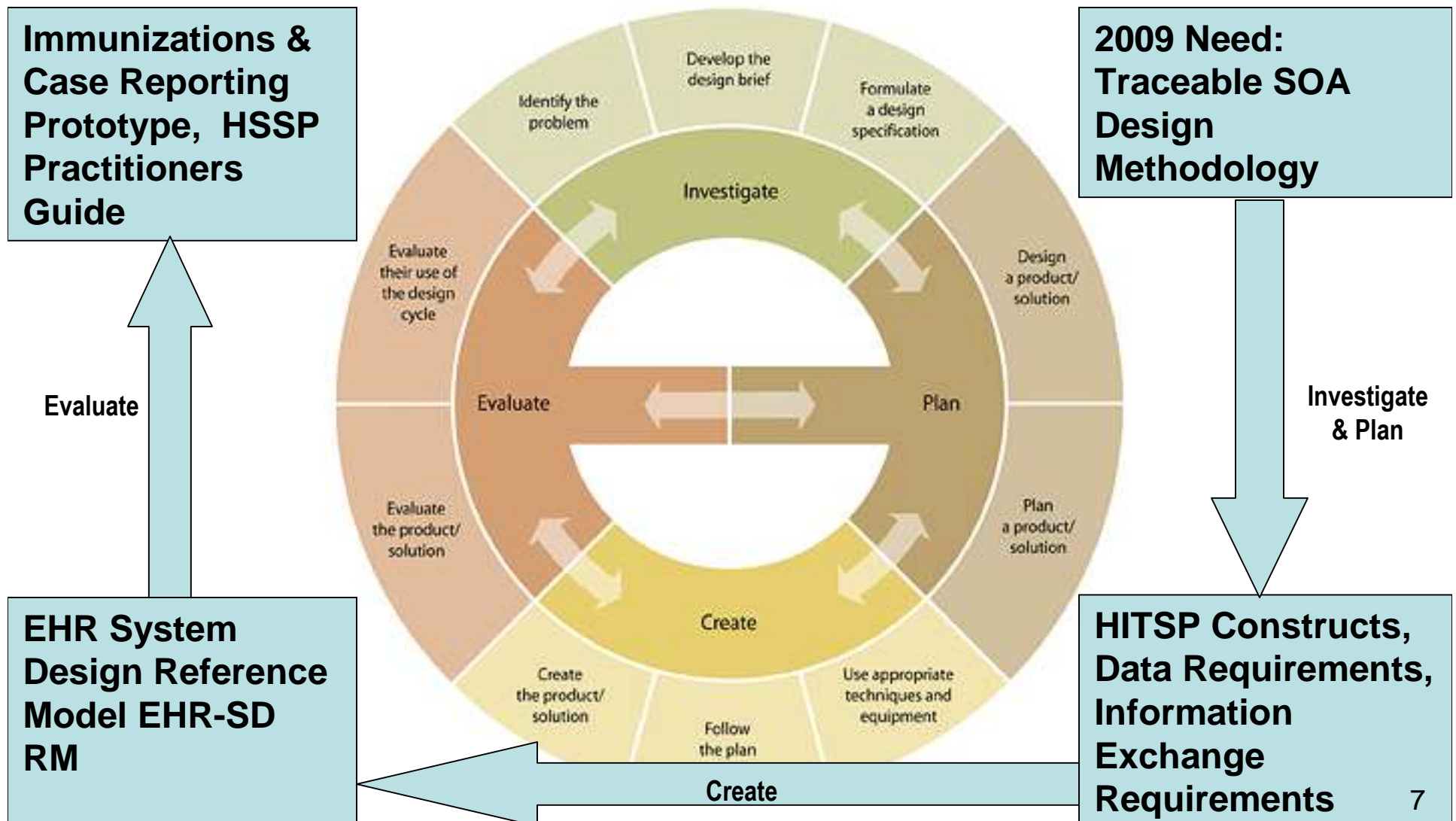
Based on HL7 EHR System Functional Model & Thomas Erl's SOA Layers

HL7 System Functions →	Direct Care	Supportive	Information Infrastructure	Other
Business Process Value Chains				
Composite Services	Federated Composition (e.g., Choreograph or Orchestration) Within and Across Business Areas			
Core Business Services	Functional Areas + Focal Classes	Functional Areas + Focal Classes	Functional Areas + Focal Classes	Functional Areas + Focal Classes
Entity Services	Information Management	Information Management	Information Management	Information Reporting and Management
Agnostic Services	Cross Technical "Common Services" (e.g., Security, Privacy, Auditing, Logging...)			
Application Services	Ambulatory Care Systems, In Patient Care Systems	Logistics Systems Financial Systems Decision Support Systems	Data Marts Repositories	Business Objects
Implementation Profiles	Integrated Healthcare Enterprise (IHE) Profiles	Analysis Profiles	Communications Profiles/Stacks	Implementation Profiles

# 2009 System Design Lifecycle

## EHR System-Design Reference-Model

### EHR-SD RM



## 2009 Tasks

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1. 2009 Work Through HITSP
2. Prototype
3. HITSP IERs
4. Candidate Services
5. Next Step/ Work Plan

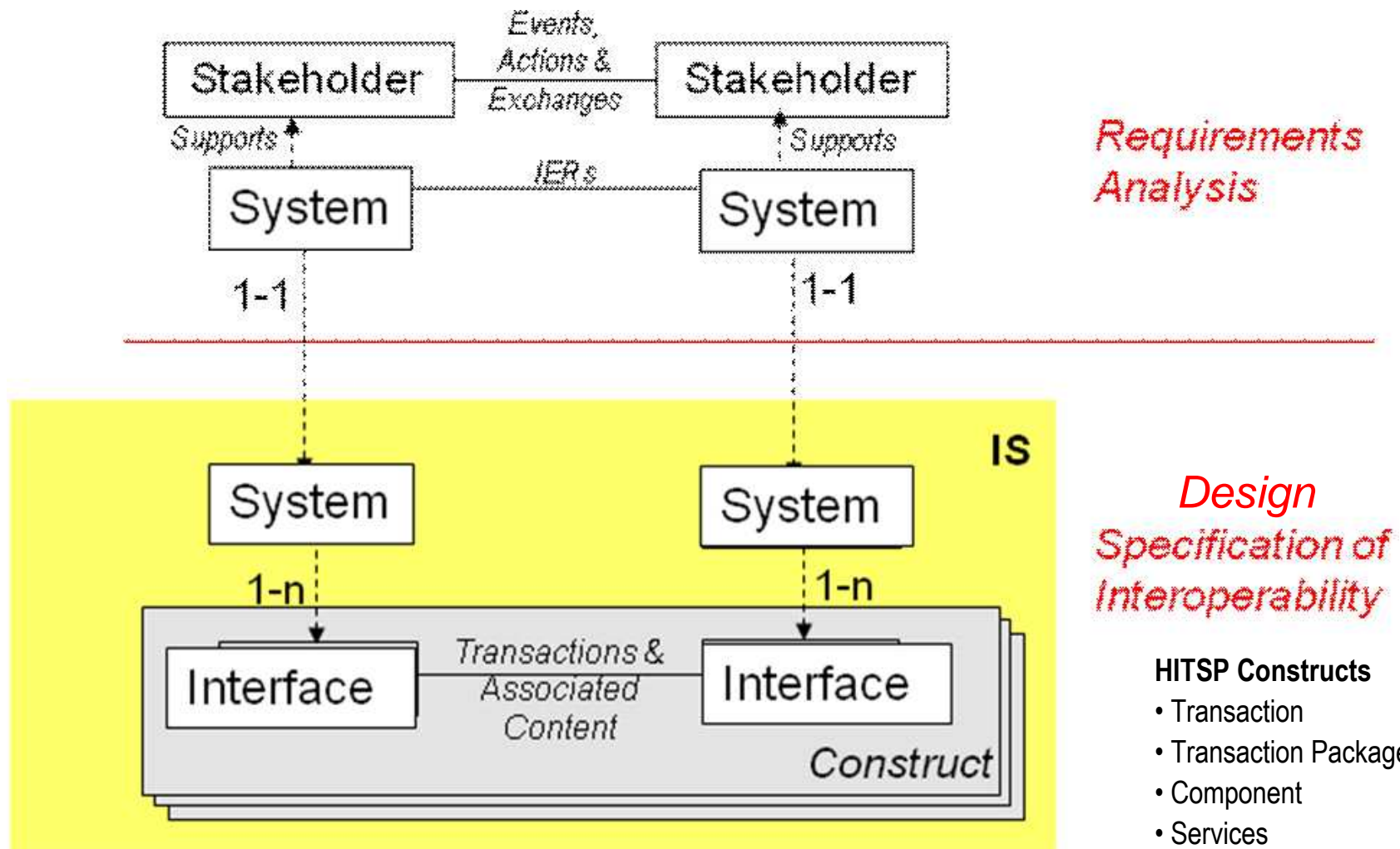


# Agenda

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1. Review H-SOA Reference Architecture Project deliverables
2. **Understand 2009 HITSP work on Information Exchanges among the Use Cases**
3. Building the content of the System Domain RM from HL7, HITSP, DOD components
4. Use Case PHER
5. SD analysis. On PHER

# HITSP Model To Link Requirements to Design



# Agenda

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4. **Use Case PHER**
5. **SD analysis. On PHER**

# EHR-SD RM Prototype

## Information Exchange Requirements (IERs)

### Use Case 1: Immunization and Response Management (IRM)

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- *IER10 Identify patient*
- *IER13 Send/receive notification of document availability*
- *IER18 Send/receive clinical document*
- *IER26 Identify communication recipients*
- *IER27 Send non-patient notification message or alert*
- *IER40 Query for existing data*
- *IER42 Request/receive medical concept knowledge*
- **IER54 Query/response for clinical message data**
- **IER67 Send/receive clinical message**
- **IER78 Send/receive Vaccine Inventory Requirements**
- **IER79 Query/response for inventory usage data**
- **IER80 Send/receive Vaccine Inventory Data**

**Blue Italics**  
indicates IERs,  
which are  
common to 1-  
IRM and 2-  
PHCR

For details, see HITSP IS 10  
Immunization and Response  
Management, available at  
[www.HITSP.org](http://www.HITSP.org)

# EHR-SD RM Prototype

## IRM Information Exchange Requirements (IERs)

### Use Case 2: Public Health Case Reporting (PHCR)

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- *IER10 Identify patient*
- *IER13 Send/receive notification of document availability*
- *IER18 Send/receive clinical document*
- *IER26 Identify communication recipients*
- *IER27 Send non-patient notification message or alert*
- **IER29 Send/receive electronic form for data capture**
- *IER40 Query for existing data*
- *IER42 Request/receive medical concept knowledge*
- **IER49 Report confirmation**

***Blue Italics***  
*indicates common  
across 1-IRM and  
2-PHCR*

For details, see HITSP IS 10  
Immunization and Response  
Management, available at  
[www.HITSP.org](http://www.HITSP.org)

# EHR-SD RM Prototype

## Information Exchange Requirements (IERs)

### HITSP Security and Privacy

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- *IER01 Provide authorization and consent*
- *IER02 Send data over secured communication channel*
- *IER03 Create audit log entry*
- *IER04 Synchronize system time*
- *IER05 Verify entity identity*
- *IER06 Provide proof of document integrity and origin*
- *IER55 Anonymize patient identifiable data*
- *IER56 Pseudonymize patient identifying information*

***Blue Italics***  
*indicates common  
across IRM and  
PHCR*

For details, see HITSP IS 10  
Immunization and Response  
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# EHR-SD RM Prototype

## Data Requirements (DRs)

### Use Case 1: Immunization and Response Management (IRM)

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- ***DR08 Unstructured Data***
- DR11 Immunization response data
- DR12 Adverse Event Report
- DR13 Drug/Vaccine Inventory Data
- DR14 Drug/Vaccine Inventory Usage Data
- DR15 Drug/Vaccine Inventory Availability Data
- DR16 Supply Chain Management Vaccine Recall
- ***DR17 Decision Support Data***
- DR18 Vaccination Data
- DR19 Medication Administration data
- DR20 Aggregate Inventory of Available Vaccine
- ***DR21 Terminology Data***
- DR22 Generic Alert Data
- DR23 Consumer Vaccination View

***Blue Italics***  
*indicates common  
across IRM and  
PHCR*

For details, see HITSP IS 10  
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# EHR-SD RM Prototype

## Data Requirements (DRs)

Use Case 2: Public Health Case Reporting (PHCR)

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- *DR08 Unstructured Data*
- *DR17 Decision Support Data*
- *DR21 Terminology Data*
- DR24 Case Report Pre-populate Data
- DR22 Generic Alert Data
- DR23 Consumer Vaccination View
- DR24 Case Report Pre-populate Data
- DR25 Case Report Content
- DR26 Reporting Criteria Content
- DR59 Generic Alert Data

***Blue Italics***  
*indicates common  
across IRM and  
PHCR*

For details, see HITSP IS 10  
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# HITSP List of Priority Information Exchanges

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1. Demographics
2. Problem List
3. Medications
4. Allergies
5. Progress Notes and Other Narrative Documents (History and Physical, Operative Notes, Discharge Summary)
6. Departmental Reports (Pathology/Cytology, GI, Pulmonary, Cardiology etc.)
7. Laboratory Results
8. Microbiology
9. Images
10. Administrative Transactions (Benefits/Eligibility, Referral/Authorization, Claims/Remittance)
11. Quality Measures
12. Privacy and Security

# Candidate Services Sources

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## **2008 H-SOA-RA**

1. Identity
2. Terminology
3. Authorization
4. Scheduling
5. Supply Chain (order/charge)
6. Document
7. Records Management
8. Decision Support
9. Performance
10. Data Management

## **DoD-VA Sharing Project**

1. Pharmacy Data
2. Clinical Data
  - Theater
3. Allergy Data
4. Lab Results
5. Discharge Summaries
6. Standard Ambulatory Data Record
7. Radiology Reports
8. Assessments
  - Pre and post deployment
9. Inpatient Consults

# Candidate Services Sources

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## **NHIN Services**

1. Subject Discovery
2. Query for Documents
3. Retrieve Documents
4. Query Audit Log
5. Authorization Framework
6. Consumer Preferences Profile
7. Messaging Platform
8. Pseudonymization
9. Health Information Event  
Messaging
10. NHIE Service Registry

## **HITSP Constructs as Services**

1. Document Sharing
2. Patient Indexing
3. Security
4. Content Definition
5. Healthcare Services
6. Health Coverage
7. Decision Support
8. Dynamic Data
9. Data Aggregation
10. General Communication

# **EHR-SD RM**

## **Next Steps/ Work Plan – 1 (Framework)**

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1. Populate a framework of candidate healthcare services, with IERs, based on SAEAF service categories
  - Define priority Information Exchange Requirements (IERs) Define priority Data Requirements (DRs) along with IERs.
  - Map IERs and DRs to the framework of candidate healthcare services
  - Build Catalog of candidate Services from 2008 H-SOA-RA work
  - Show AHIC-HITSP traceability (e.g., AHIC IERs to HITSP ISs to standards)
  - Show NHIN traceability (align with NHIN services)
  - Show CCHIT traceability (align with CCHIT test criteria)
  - Compare and contrast framework of candidate healthcare services with Canada Infoway's SOA and/or other SOA

# **EHR-SD RM Next Step/ Work Plan – 2 (Macro View)**

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## **2. Define EHR-SD RM**

- Map Priority IERs and DRs to EHR-S FM
- Map candidate services to EHR-S FM
- Define EHR-SD RM based Business Transformation Architecture methodology for

## **3. Identify gaps and overlaps in HL7's portfolio**

- Identify artifacts that do not now exist but are indicated in the EHR-S FM
- Identify the extent of duplication that may exist across HL7 artifacts

# EHR-SD RM Next Steps/ Work Plan – 3 (Prototype)

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4. **Create prototype EHR-SD RM validation case study prototype**, using
  1. AHIC-HITSP Public Health and Emergency Response use cases and Interoperability Specifications
  2. Services Aware Enterprise Architecture Framework (SAEAF)
  3. HITSP Multi-Enterprise Architecture of Networked Services Standards (MEANS) and
  4. HL7 HSSP Practical Guide for SOA in Healthcare “sample health” example specifications.
  5. Include mapping to MHS and DOD specific IERs and DRs
5. **Publish HL7 HSSP Practical Guide for SOA in Healthcare Part 2: Case Study.**
  1. To show HITSP, NHIN and CCHIT conformance criteria, use
    1. OMG Object Constraint Language and/or
    2. OWL Semantic Ontology specification language

# Questions?

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## Contact Information

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# Backup Slides

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# Introduction

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In '2004, Executive Orders 13335 set the objective for National Electronic Healthcare Record (EHR) Interoperability by '2014. In '2006, Executive Order 13410 mandated Federal agencies to begin transformation to Healthcare Information Technology Standards Panel (HITSP) conformant EHR interoperable systems by '2007. We present a standards-based strategic approach for interoperability at the service level to construct semantically consistent interoperable Enterprise Architectures (EAs). It builds upon the functional foundation of the HL7 EHR System Functional Model (EHR-S) and the technical foundation of Thomas Erl's Service Oriented Architecture (SOA) model to specify a standard Healthcare SOA Reference Architecture (H-SOA-RA). Information Exchange Requirements (IERs) are used to identify services and as the key to traceability from requirements to implementation, test and certification.

# Project Intent

- 
- Implement a step in HL7 roadmap
    - Identify gaps and overlaps in HL7's portfolio
    - Identify gaps in the EHR-S FM
    - Pilot HL7 ARB Services Aware Enterprise Architecture Framework (SAEAF) methodology
  - Validate HITSP Multi-Enterprise Architecture of Networked Services Standards (MEANS) methodology
  - Create Healthcare SOA Reference Architecture (H-SOA-RA) Version 2
  - Create Healthcare SOA EHR System Design Reference Model (EHR-SD RM) based on EHR System Functional Model (EHR-S FM)
  - Create prototype architectural case study using HL7 HSSP Practical Guide for SOA in Healthcare “sample health” and service specifications, EHR-S FM, EHR-SD RM, AHIC Use Cases, HITSP Interoperability Specifications and NHIN services.
  - Demonstrate standards-based Model Driven Architecture (MDA) approach

# Project Scope

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1. This project will mature the April 2008 Healthcare Services Oriented Reference Architecture (**H-SOA-RA**) version 1.0 into H-SOA-RA Version 2.0 and then
2. integrate it into an EHR System Design Reference Model (**EHR-SD RM**),
  1. using the HL7 SOA-Aware Enterprise Architecture Framework (SAEAF),
  2. HITSP Multi-Enterprise Architecture of Networked Services Standards (MEANS),
  3. EHR System Functional Model (EHR-S FM).
3. Emphasis will be placed on maintaining AHIC, HITSP, NHIN and CCHIT conformance by maintaining Information Exchange Requirements (IERs) and Data Requirements (DRs) traceability.
4. Mapping and analysis of the HL7 product portfolio against the EHR-S FM will be used to integrate the reference architecture with HL7 product lines and initially mature the resulting model as a technical white papers, then
5. an informative reference model and finally a standard reference model.
6. An HSSP based prototype case study architectural specification will be built to validate the effort using the AHIC-HITSP Immunization and Response Management and Public Health Case Reporting use cases

# Project Schedule

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- Sep 2008 – Healthcare SOA Reference Architecture (H-SOA-RA)
- Jan 2009 – harmonize and catalogue priority IERs, DRs and candidate services
- Mar 2009 – map priority IERs, DRs and candidate services to EHR-S FM
- Jun 2009 - Mappings of V2.5, V3 products to EHR-S FM
- Jun 2009 - Present at HL7 SOA Conference (for peer feedback)
- Sep 2009 – Healthcare SOA Reference Architecture (H-SOA-RA) version 2.0
- Sep 2009 - HSSP *Practical Guide for SOA in Health Care*, Part II: Case Study
- Sep 2009 - EHR-SD RM white paper for HL7 committee comments, to socialize the project.
- Sep 2010 - EHR-SD RM Balloted as informative document
- Sep 2011 - EHR-SD RM Balloted as a standard

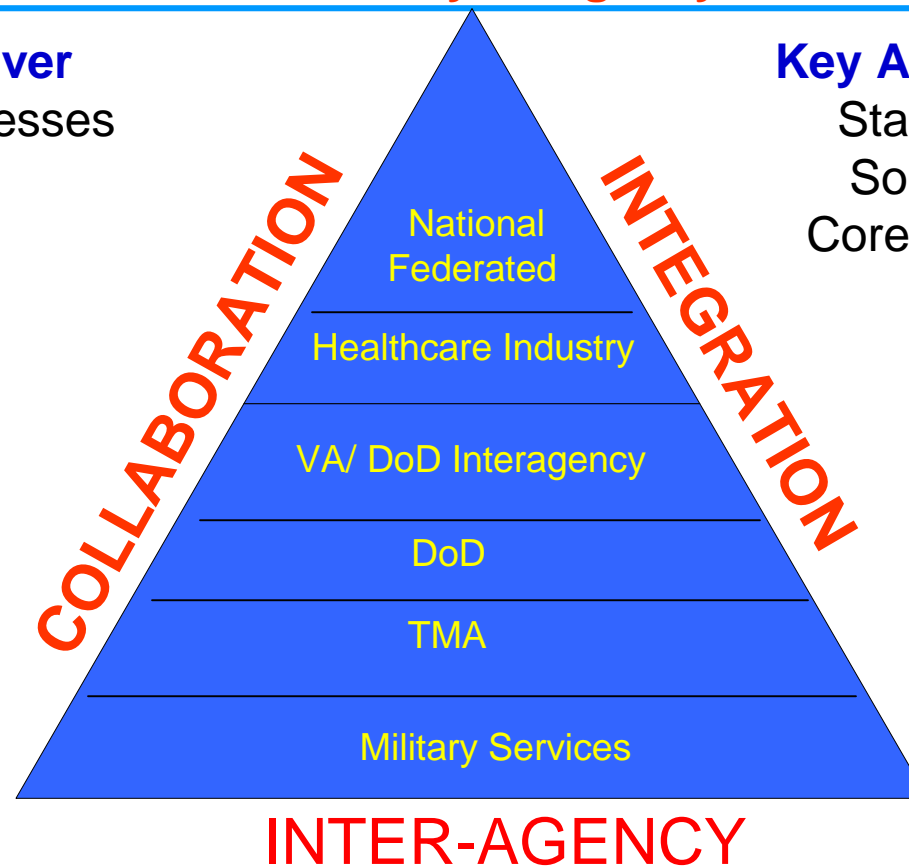
# **Goal: 2008 Project Goal**

## **Healthcare SOA Reference Architecture (H-SOA-RA)**

**Identifying Opportunities to Leverage Technology and  
Alleviate Redundancy or Agency IT Overlap**

**Key Business Driver**  
Patient Centric Processes

**Key Architectural Objective**  
Standardized Technical  
Solutions aligned with  
Core Business Processes.



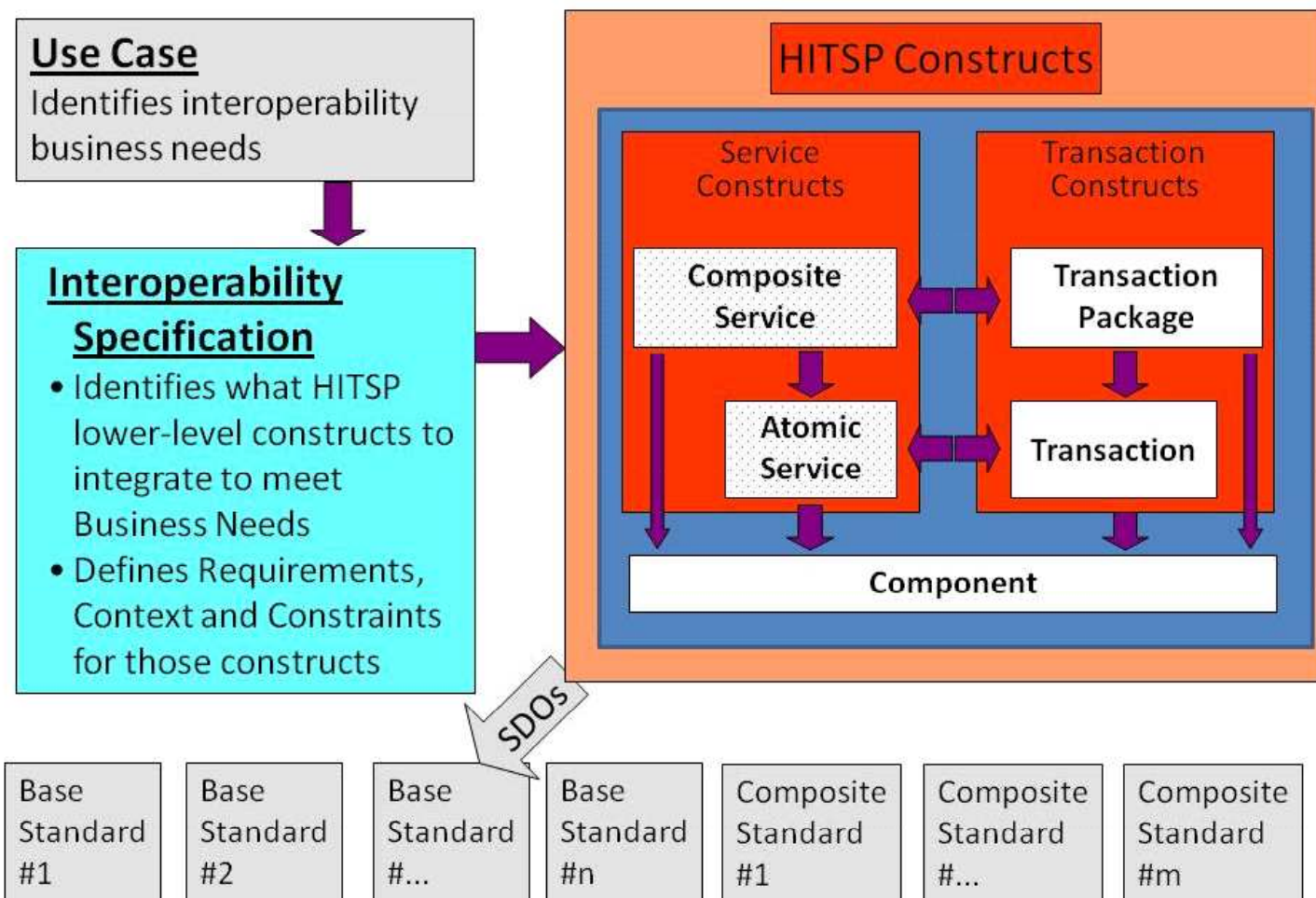
**Joining Forces to Improve Effectiveness, Efficiency, and Service delivery**

# HITSP ARRA Tiger Teams

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1. EHR-Centric Light-Weight Interoperability Specification
2. Harmonization Framework and Exchange Architecture
  - Information Exchange Model
3. Data Architecture
4. Security, Privacy and Infrastructure
  - Service Collaboration Suite
5. Quality Measures

# HITSP Document Framework



# HITSP Model for Information Exchange Requirements (IERs)

Information Exchange Number	Exchange Action	Exchange Content	What System initiates this exchange?	What System (s) consume this exchange?	Qualifier
	Send	Blood Lab Report	Laboratory Information System	PHR System EHR System Public Health Information System	TBD
	Send	Specimen Lab Report	Laboratory Information System	PHR System EHR System Public Health Information System	TBD

Reusable Facets → Lexical Consistency



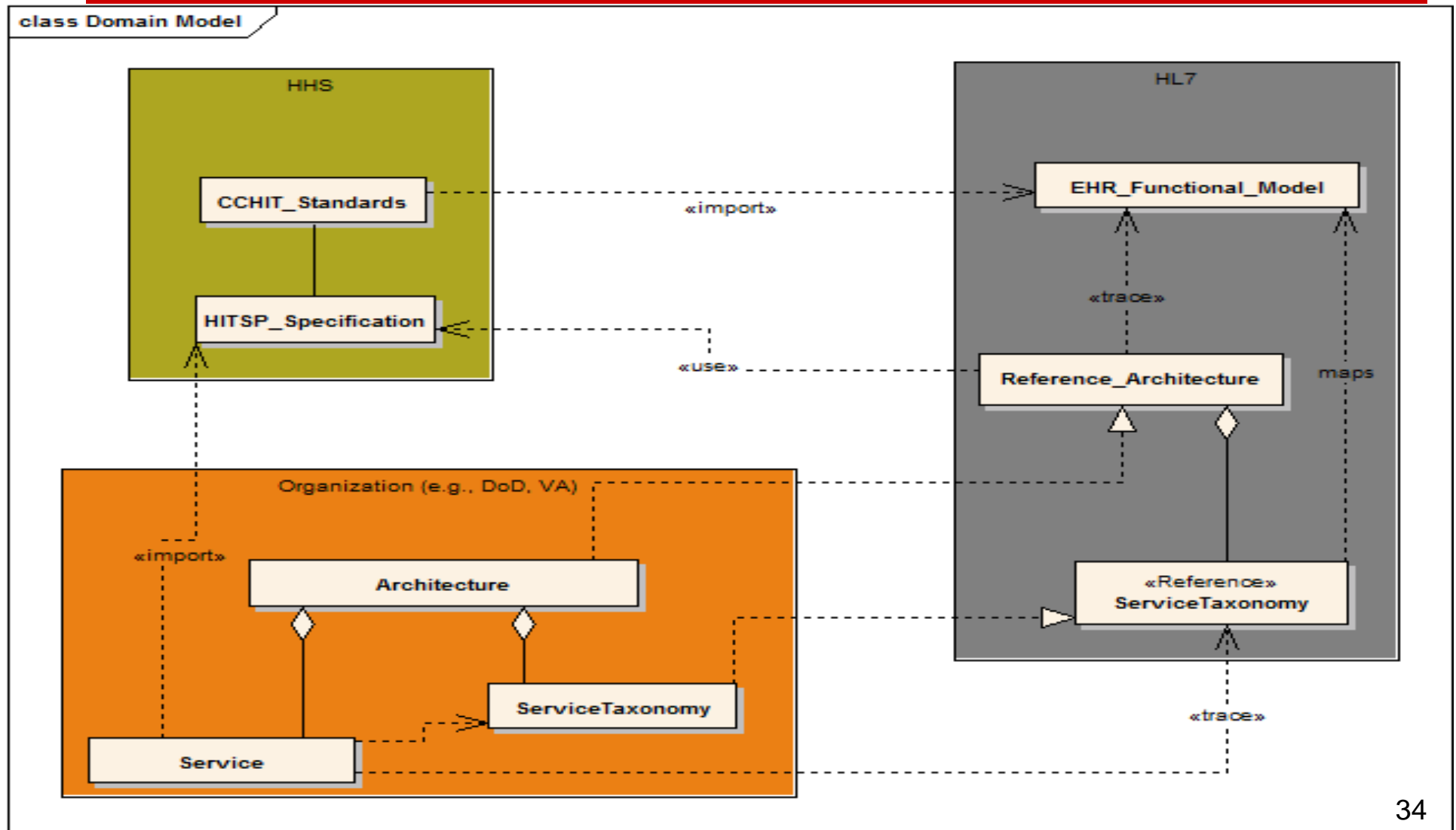
# HITSP Exchange Content Contain Data Requirements (DRs)

Exchange Content Number	Exchange Content Name	Definition of the Exchange Content	Data Requirements
	Genomic Decision Support Data	Information from genetic/genomic knowledge sources and/or decision support modules within EHRs (including Fx HX and Test Results)	<u>DR1</u> Demographic Data <u>DR3</u> Clinical History <u>DR4</u> Personal genetic/genomic data <u>DR5</u> Family genetic/genomic information <u>DR8</u> Unstructured Data

CDA and ANSI X12 Data Modules  
Reusable DRs → Lexical Consistency

# 2008 Service Traceability

## EHR-S, HITSP and CCHIT



# HL7 EHR System

## Functional Model (EHR-S)

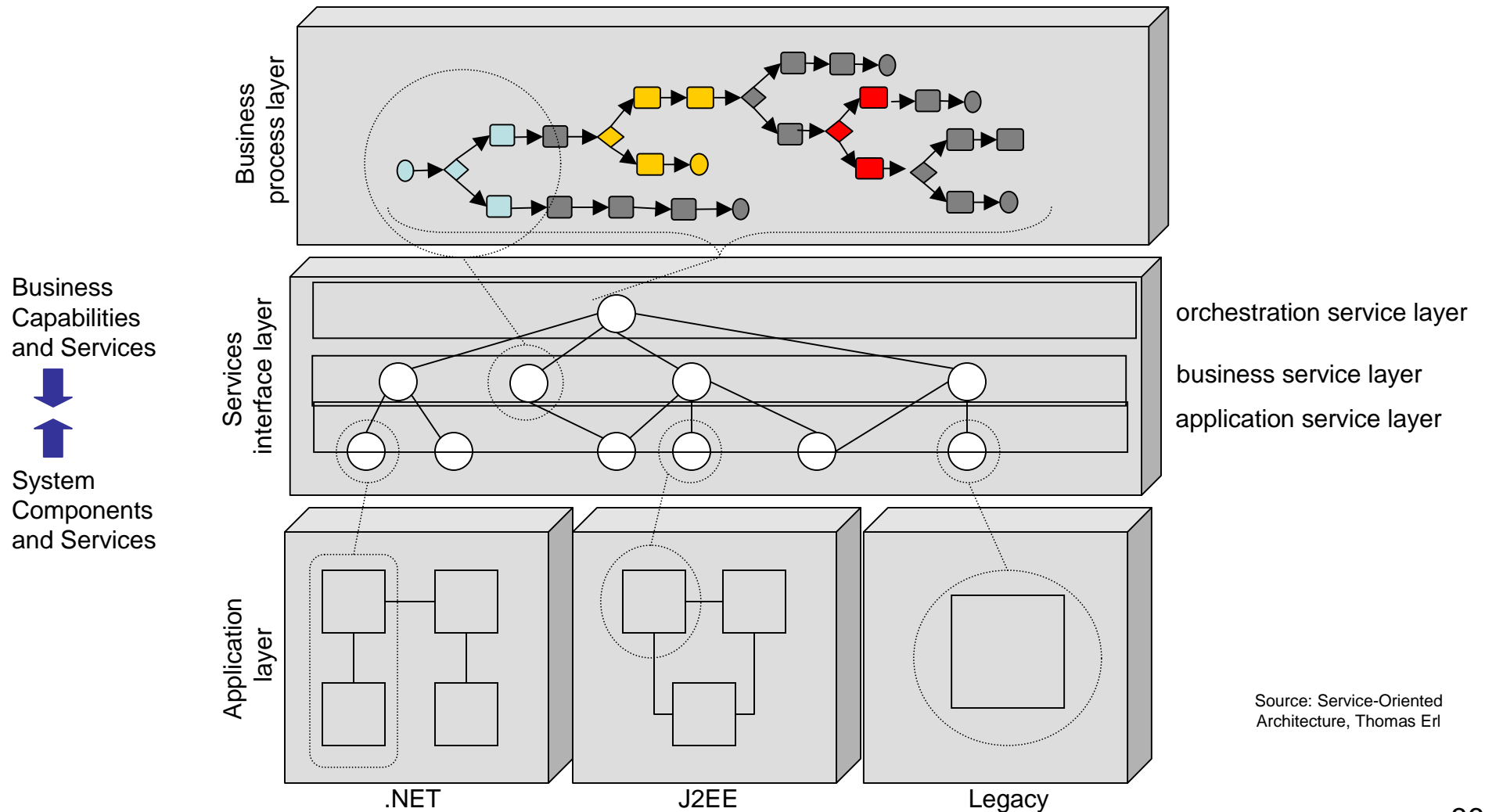
(> 230 System Functions in 4 level categorization  
(see separate spreadsheet for full enumeration)

System Functions	Direct Care	DC.1	Care Management	Business	Service Types
		DC.2	Clinical Decision Support	Choreography	
		DC.3	Operations Management and Communication	Choreography	
	Supportive	S.1	Clinical Support	Business	
		S.2	Measurement, Analysis, Research and Reports	Entity (Information)	
		S.3	Administrative and Financial	Business	
	Information Infrastructure	IN.1	Security	Infrastructure	
		IN.2	Health Record Information and Management	Entity (Information)	
		IN.3	Registry and Directory Services	Infrastructure	
		IN.4	Standard Terminologies & Terminology Services	Infrastructure	
		IN.5	Standards-based Interoperability	Infrastructure	
		IN.6	Business Rules Management	Business	
		IN.7	Workflow Management	Choreography	
	Other	O-1	Electronic Resource Planning (ERP)		
		O-2	Finances		
		O-3	Other		

**NOTE: "Other" Category** - The EHR-S model does NOT include Electronic Resource Planning (ERP) / Logistics and Financial components, which are needed for completeness of a military EHR.

# SOA Layers

## Focus on the Business Processes and Services [Thomas Erl]



Source: Service-Oriented Architecture, Thomas Erl

# **SOA Service Models**

## **Potential Service Layers** [Thomas Erl]

<b>Service Model</b>	<b>Description</b>
Application Service	A generic category used to represent services that contain logic derived from a solution or technical platform. Services are generally distinguished as application services when creating abstraction layers.
Business Service	A generic category used to represent services that contain business logic. When establishing specialized service layers, services that fall into the business service layers are collectively referred to as business. However, individually these services are classified as entity-centric (e.g., information) or task-centric business services.
Controller Service	A Service that composes others. Variations of this model exist, depending on the position of the controller in the composition hierarchy. The patent controller service can be classified as the master controller and a service that composes a subset of a larger composition can be labeled as sub-controller.
Coordinator Services	Three service models are derived from the concept of coordination: the coordinator, the atomic transaction coordinator, and the business activity coordinator. All three models are specific to the WS-Coordination specification and related protocols.
Entity-centric Business Service	A business process-agnostic variation of the business service that represents one or more related business entities. This type of service is created when establishing a business service layer.
Hybrid Service	A service that contains both business and application logic. Most services created as part of traditional distributed solutions fall into this category. When organizing services into abstraction layers, hybrid services are considered part of the application service layer.
Integration Service	An application service that also acts as an endpoint to a solution for cross-referencing integration purposes.
Process Service	A service that represents a business process as implemented by an orchestration platform and described by a process definition. Process services reside in the orchestration service layer.
Task-Centric Business Service	A business process-specific variation of the business service that represents an atomic unit of process logic. Task-centric services are different from process services in that the process logic is provided by the underlying service logic, not by a separate process definition.

# EHR DATA REUSE THROUGH H-SOA-RA ACROSS EPISODES OF CARE

Previous Episode  
Of Care EHR



Current Episode  
Of Care EHR



Reusable Services

## IDENTITY

- Patient Demographics
- Provider Demographics
- Insurer Demographic

## Terminology

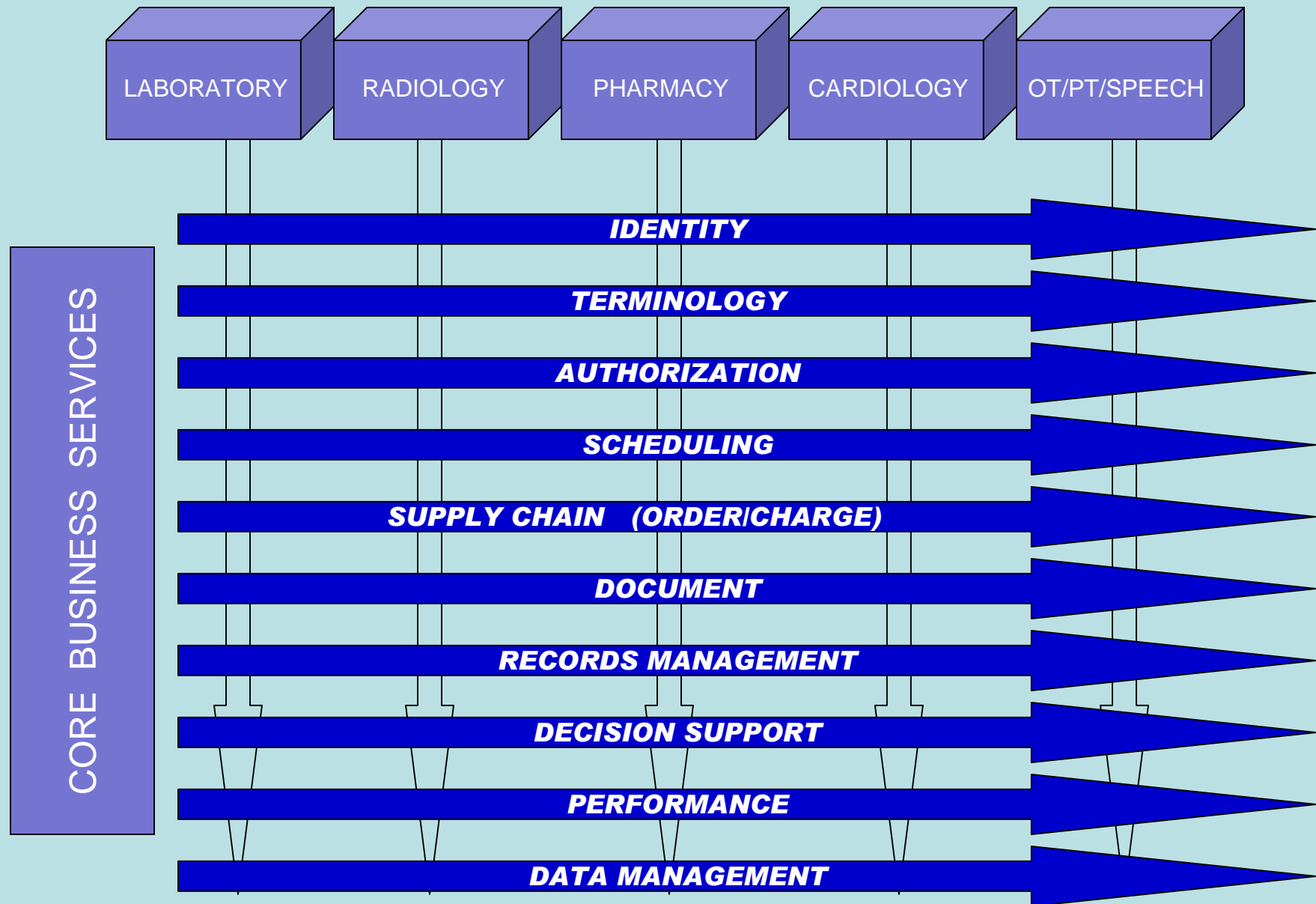
- Chronic Diagnoses
- Procedure History

## Document

- Patient History
- Summary Lists
  - Medication List
  - Allergy/Adverse Reaction List
  - Immunization

*Data Must Be Verified  
And Updated*

# ***ANATOMY OF ANCILLARY SYSTEMS***



# Federated Services [1]

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**Federation** is a state achieved by extending SOA into the realm of service-oriented integration. A number of key WS-\* extensions provide feature-sets that support the attainment of federation. Most notable among these are the specifications that implement the concepts of orchestration and choreography.

Establishing SOA within an enterprise does not necessarily require that you replace what you already have. One of the most attractive aspects of this architecture is its ability to introduce unity across previously non-federated environments. While web-services enable federation, SOA promotes this cause by establishing and standardizing the ability to encapsulate legacy and non-legacy application logic and by exposing it via a common, open, and standardized communications framework.

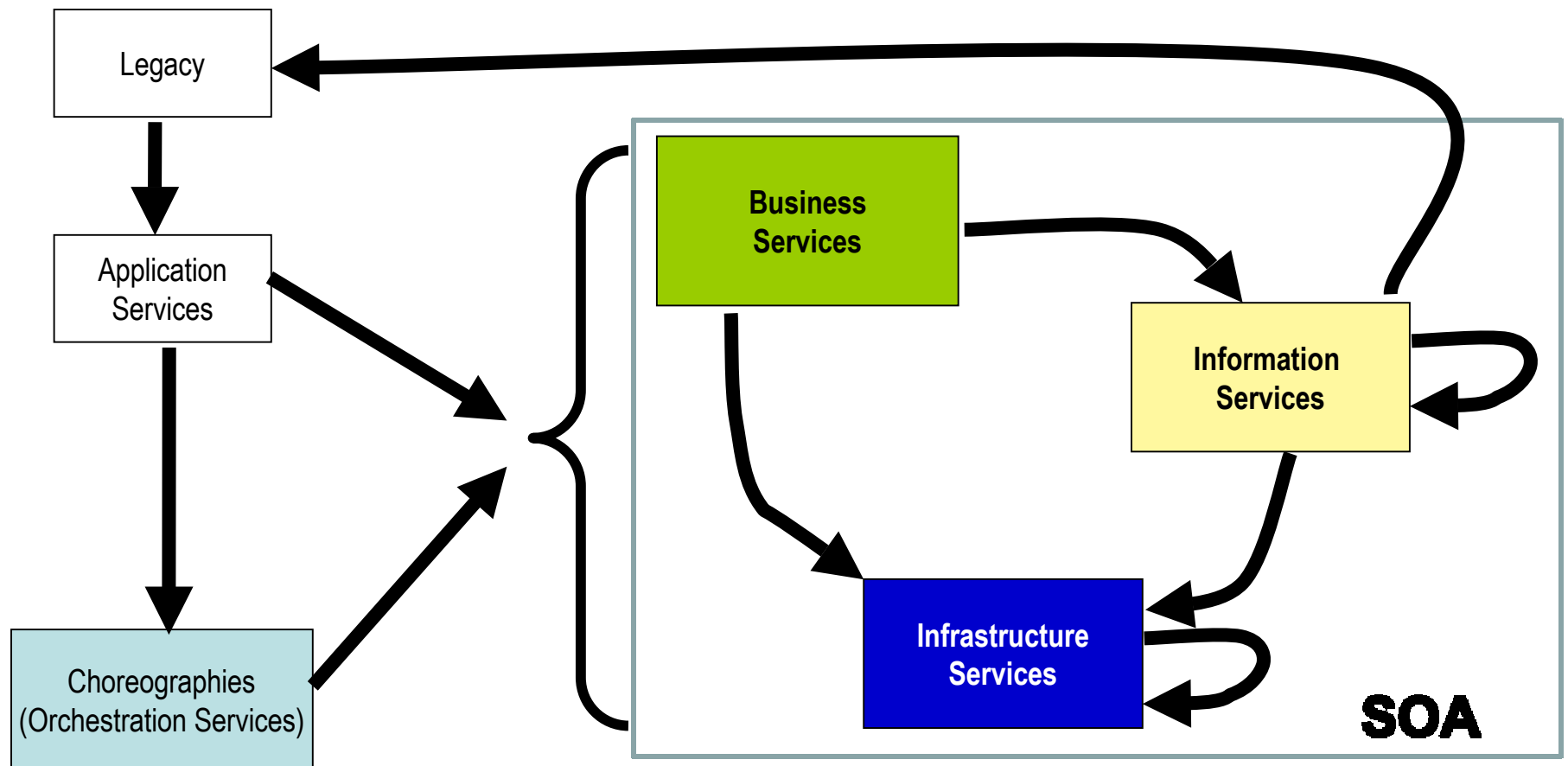
- WSRP (Web Services for Remote Portals) is the cornerstone of federated services
- SAML (Security Assertions Markup Language) is commonly used
- ALSO: WS-Security, WS-Trust, WS-Policy, WS-Federation

Additional info at: <https://www120.livemeeting.com/cc/bea/viewReg>

[1] SOA: Principles of Service Design, by Thomas Erl, Prentice Hall, July 07

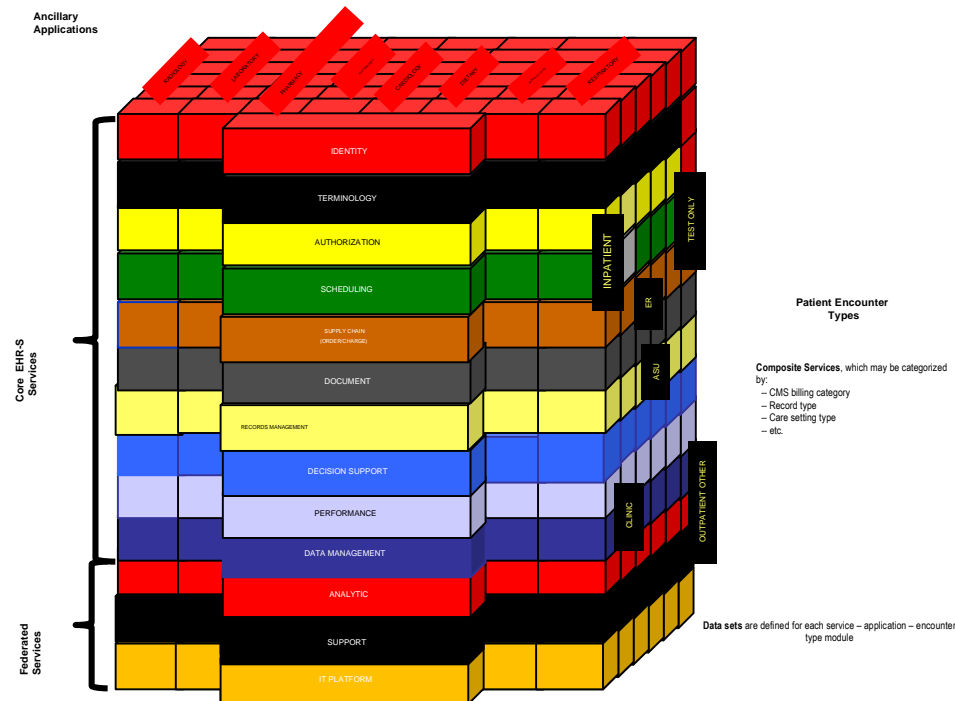


# Leveraging SOA Processing in the Enterprise



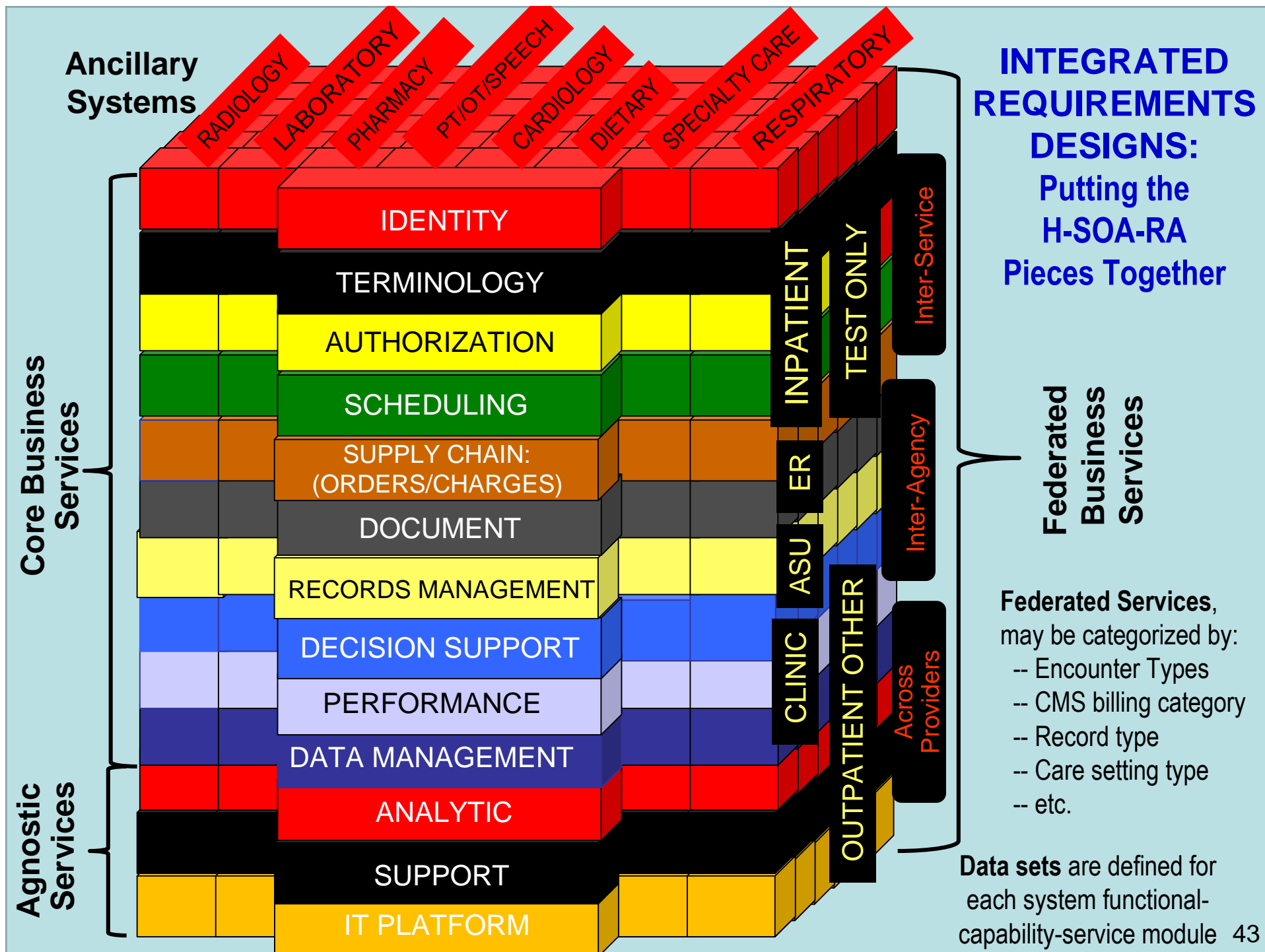
# CASE MANAGEMENT

ACROSS CARE CONTINUUM



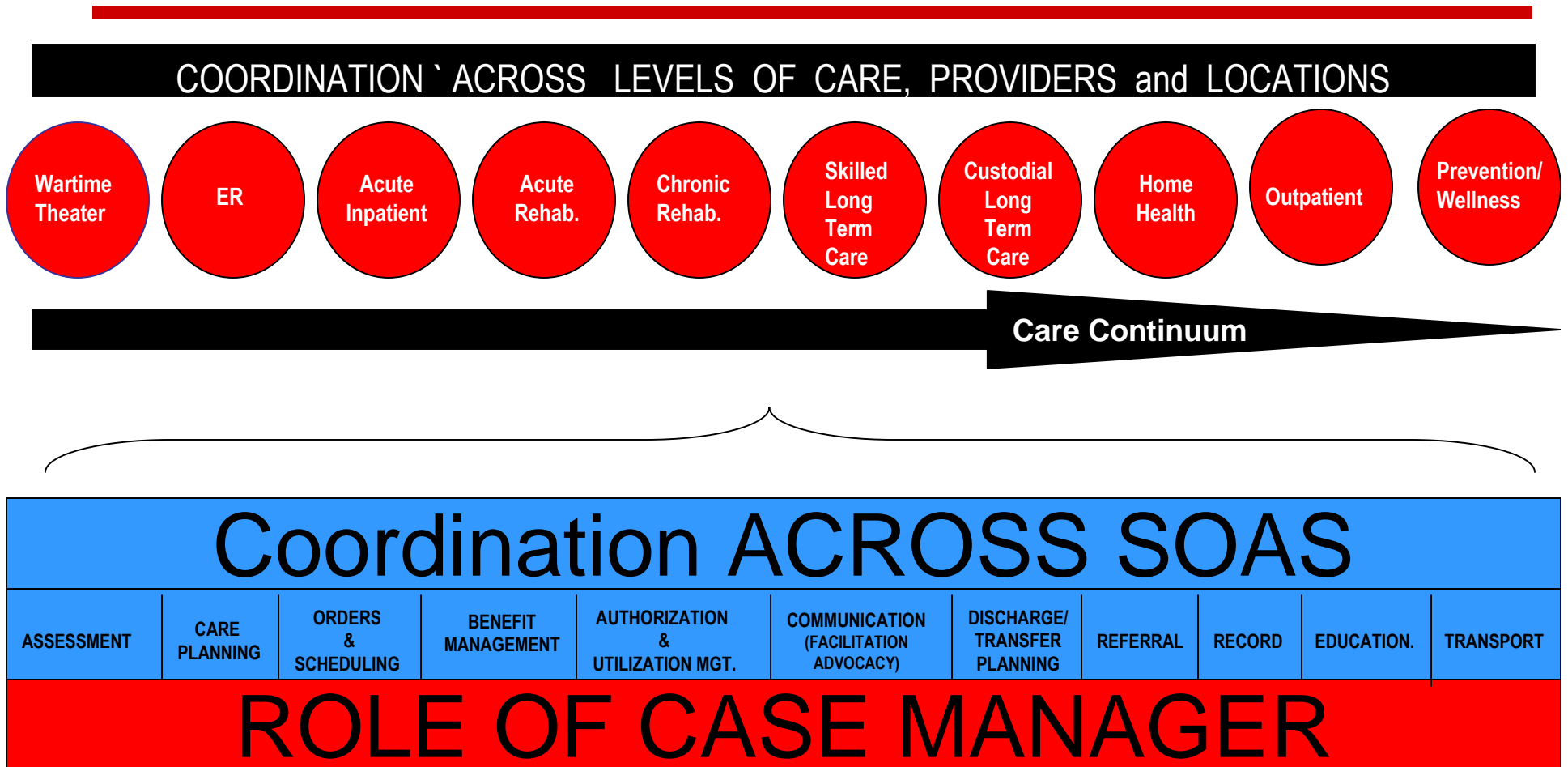
ACROSS SERVICES (SOAs)

COORDINATION



# Case Management

## Coordination Across SOAs and the Continuum



# Potential Benefits from Process Improvement through H-SOA-RA

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Elimination of Process Obstacles would result in:

- Length of Stay Reduction
- Improved Patient Outcomes / Reduced Risk
- Revenue Improvement
- Staff Efficiencies
- Improved Patient and Staff Satisfaction
- Reduced IT Expenditure/Maintenance Costs
- Improved Information Accuracy and Availability

# ADDRESSING REAL BUSINESS ISSUES THROUGH H-SOA-RA

- 
- |  |   |
|--|---|
| • Incomplete/Inaccurate Demographic Data                         | (Identity Service)                              |
| • Incomplete/Inaccurate Insurance Information                    | (Authorization Service)                         |
| • Unauthorized Service   | (Authorization Service)                         |
| • Diagnosis/Procedure Coding Errors                              | (Terminology Service)                           |
| • Service Delays   | (Scheduling Service)                            |
| • Incomplete and Inefficient Charge Capture                      | (Supply Chain Service)                          |
| • Non-indicated or Contra-indicated Services                     | (Decision Support/<br>Authorization Services)   |
| • Delays in EHR Document Production and Provision                | (Document Service)                              |
| • Billing Delays and Errors                                      | (Supply Chain/ Billing/<br>Collection Services) |
| • Not fully coordinated Scheduling                               | (Scheduling Service)                            |
| • Lack of fully integrated Patient Assessment and Treatment Plan | (Document Service/<br>Decision Support Service) |
| • Delayed or Lack of Medical Record Access                       | (Record Service)                                |

# EHR-SD RM Prototype

## Requirements from 2008 AHIC Use Cases

Use Case 1: Immunization and Response Management (IRM) and  
Use Case 2: Public Health Case Reporting (PHCR)

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1. The Immunizations and Response Management AHIC Use Case and HITSP Interoperability Specification are intended to support current interoperability approaches between **Electronic Health Records (EHRs)** and **Immunization Information Systems** while allowing for a migration toward emerging interoperability implementations and document sharing environments where **Personal Health Records (PHRs)** are able to be included in the information flow. The Interoperability Specification also allows for basic electronic information exchanges to enable requirement communications and **alerting mechanisms** and to lay the foundation for future **clinical support capabilities**.
2. The Public Health Case Reporting AHIC Use Case and HITSP Interoperability Specification supports the **bi-directional information exchanges** of the **Public Health Case Reporting** process. The Public Health Case Reporting Use Case addresses numerous domains which have similar content and processes at a high level, but which also are dissimilar in report content details and case management processes when considering any specific report.