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# Semantic Enhancements for the CONNECT Adapter

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## Agenda

- Background
- Challenge in Implementing CONNECT Adapters
- Semantic SOA as a Best Practice
- Semantic Enhancements to the CONNECT Adapter
- Semantic Mediation in the Enterprise (Beyond CONNECT)



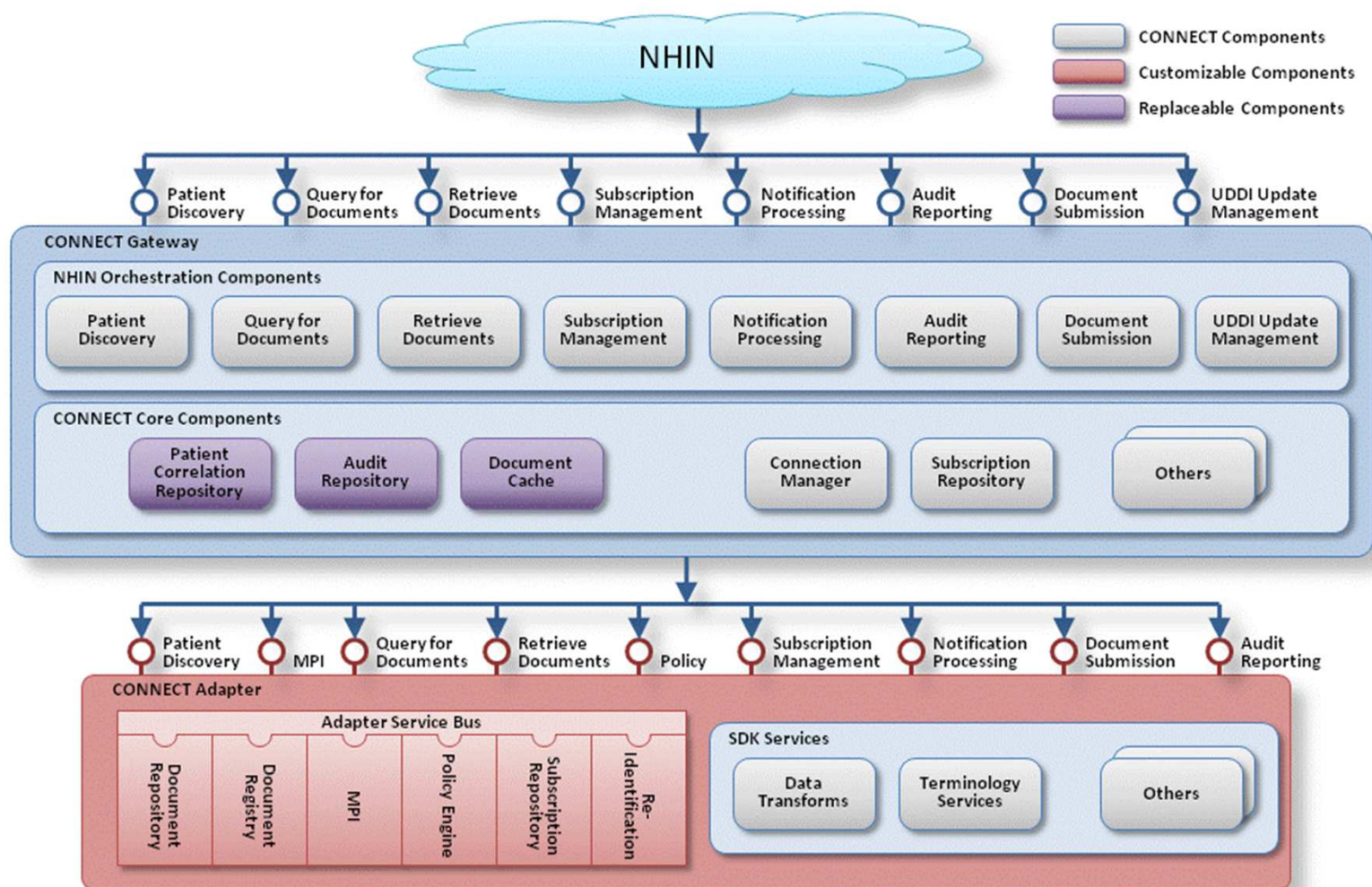
## CONNECT and National Health Information Network (NHIN)

- NHIN is a set of policies, standards and services that enable the Internet to be used for secure and meaningful exchange of health information to improve health and health care
- CONNECT is an open source implementation of the NHIN Service Interface Specifications for securely exchanging interoperable health information
  - Promotes the widespread adoption of interoperable health IT
  - Uses nationally recognized standards, conventions and trust agreements, to address multiple complex objectives simultaneously
  - A federally funded, Open Source software solution





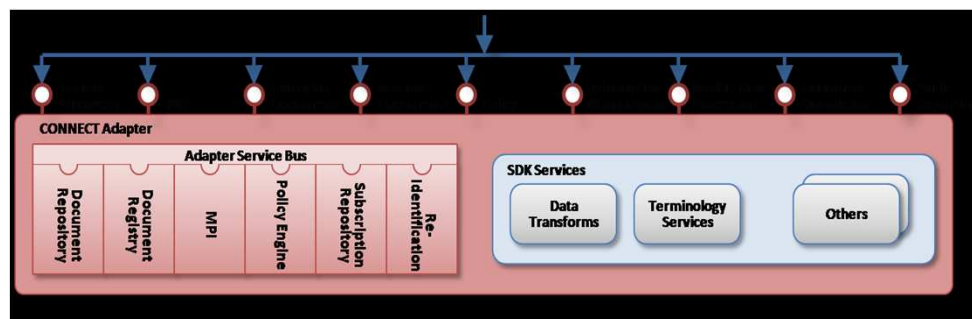
# CONNECT Architecture





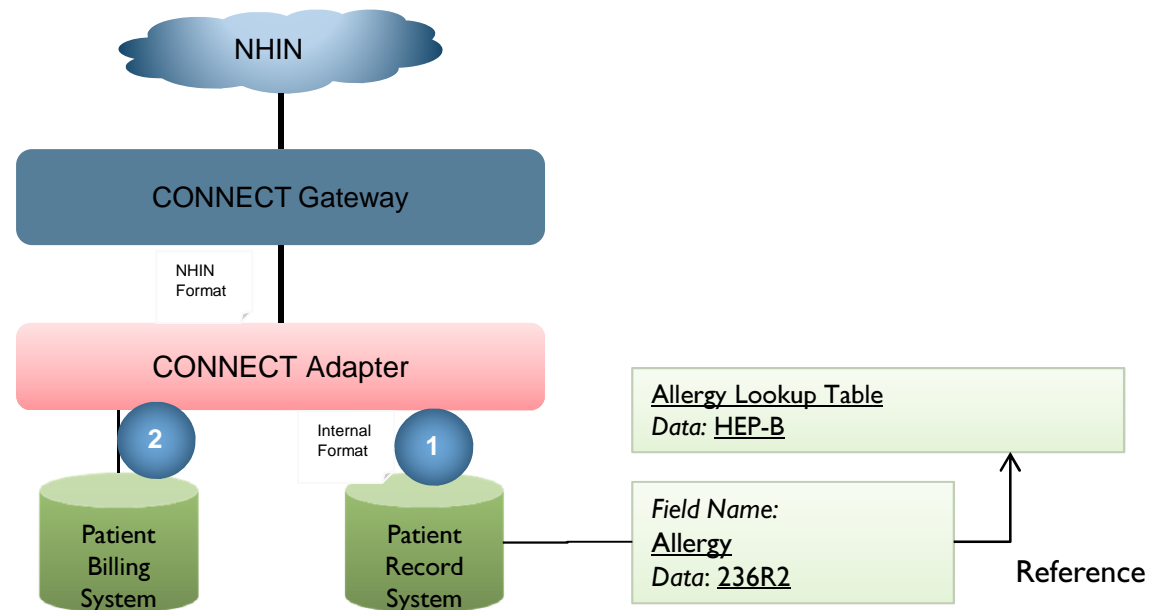
## CONNECT Adapter Framework

- CONNECT Adapter integrates the CONNECT Gateway to the organization's HIS
  - Perform message transformation between NHIN standards and HIS formats
- Significant efforts required to implement a CONNECT adapter
  - Start from adapter API and the reference implementations
  - Extend and implement the functionality of the required component





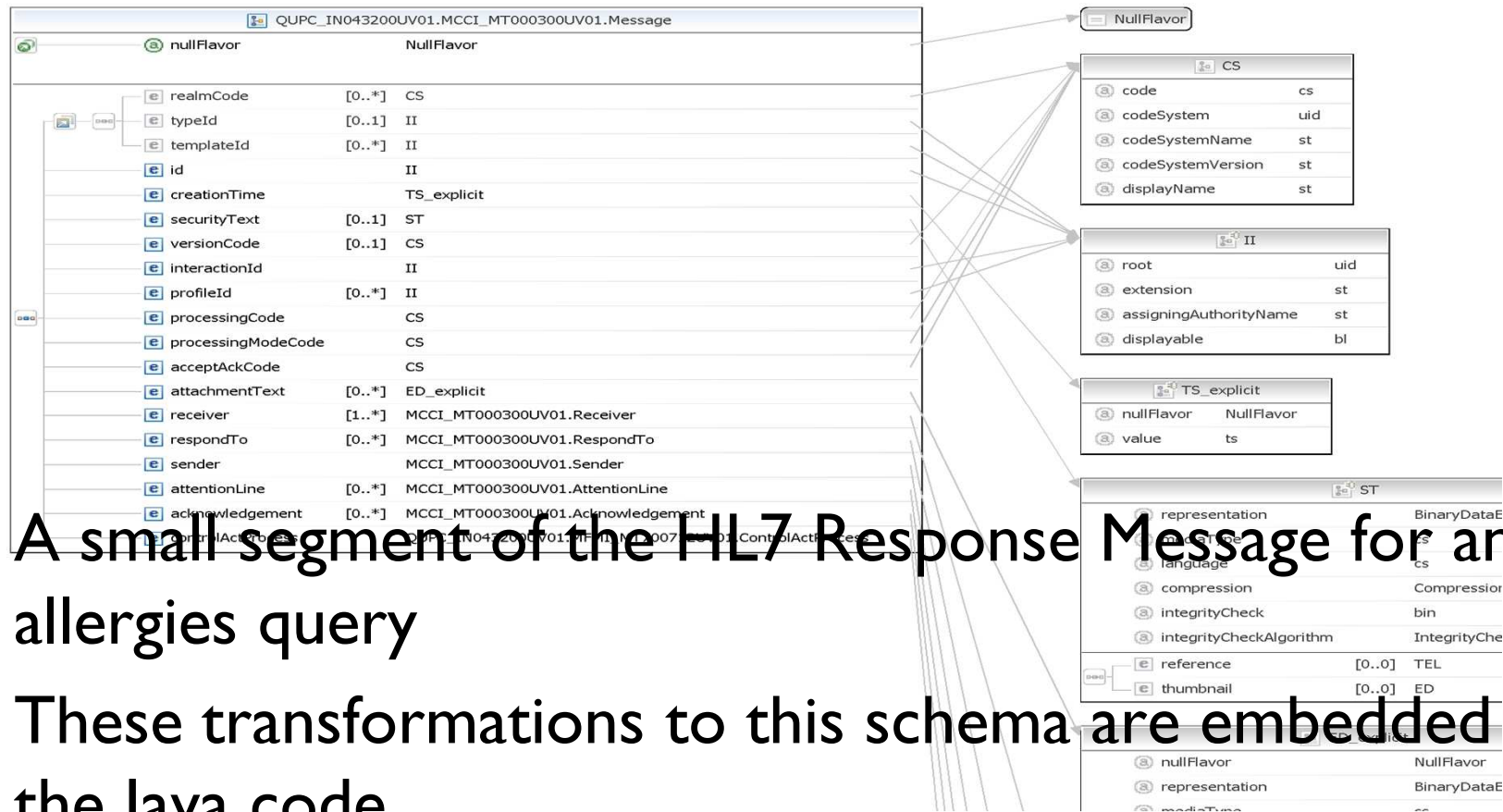
# Challenges in Implementing CONNECT Adapters



- 1 Custom coding needed for each message
- 2 Little or no re-use of this understanding can be made as new HIS instances are added or if the current ones have changes
- 3 Knowledge of the entities and their relationships is embedded inside the code



## A Developer's view of creating a custom Adapter



- A small segment of the HL7 Response Message for an allergies query
- These transformations to this schema are embedded in the Java code
- Even while using a standard format like HL7, the focus is on data exchange not Knowledge Representation





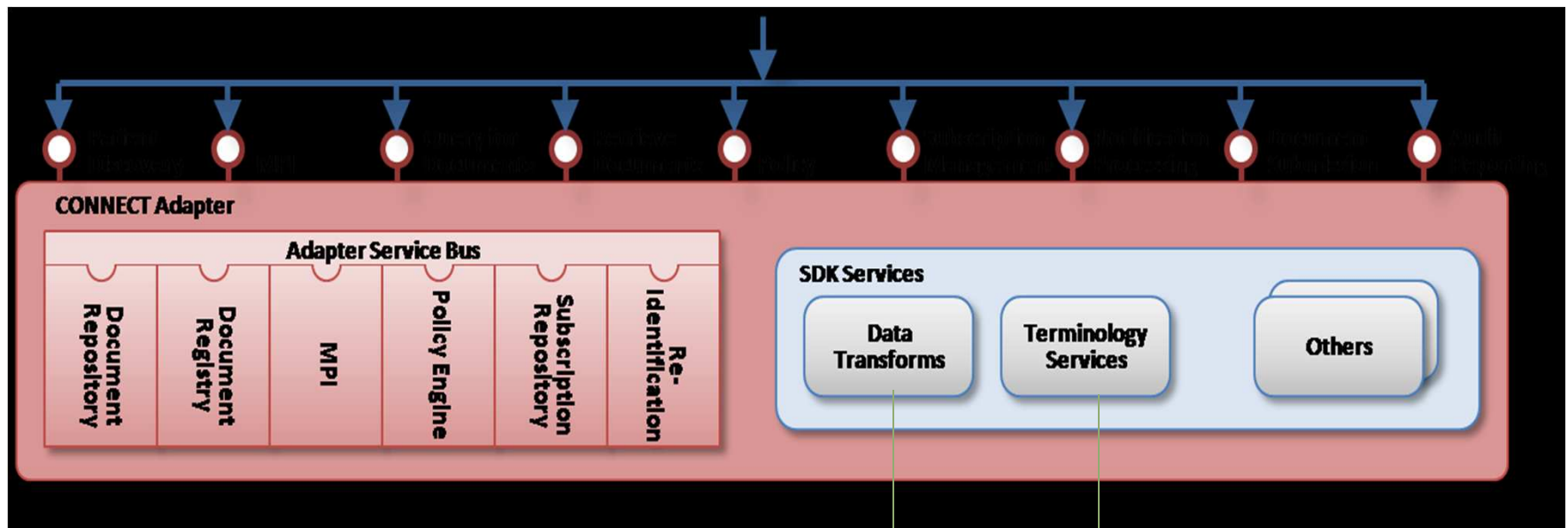
## Semantic SOA as a Best Practice

- Industry reorganizes Service Oriented Architecture (SOA) as a key enabler for service interoperability
  - Key Benefits:
    - Promotes re-use of existing services
    - Enables fast adaptation to business needs
    - Alignment of information resources to business goals
  - Challenges:
    - Finding relationships between services
    - Managing multiple messaging schemas
- Semantic SOA extends SOA by adapting proven Semantic Web Best Practices
  - Practices:
    - Defining community terms in a central enterprise ontology for interoperability and shared understanding
    - Enabling net-centric access through a semantic web services architecture
    - Utilizing semantic technology to tie it all together into an executable solution
  - Benefits
    - Promotes reuse of existing Services through improved service discovery and understanding
    - Enhances business agility through better service interoperability
    - Facilitates seamless addition of new service through improved service discoverability





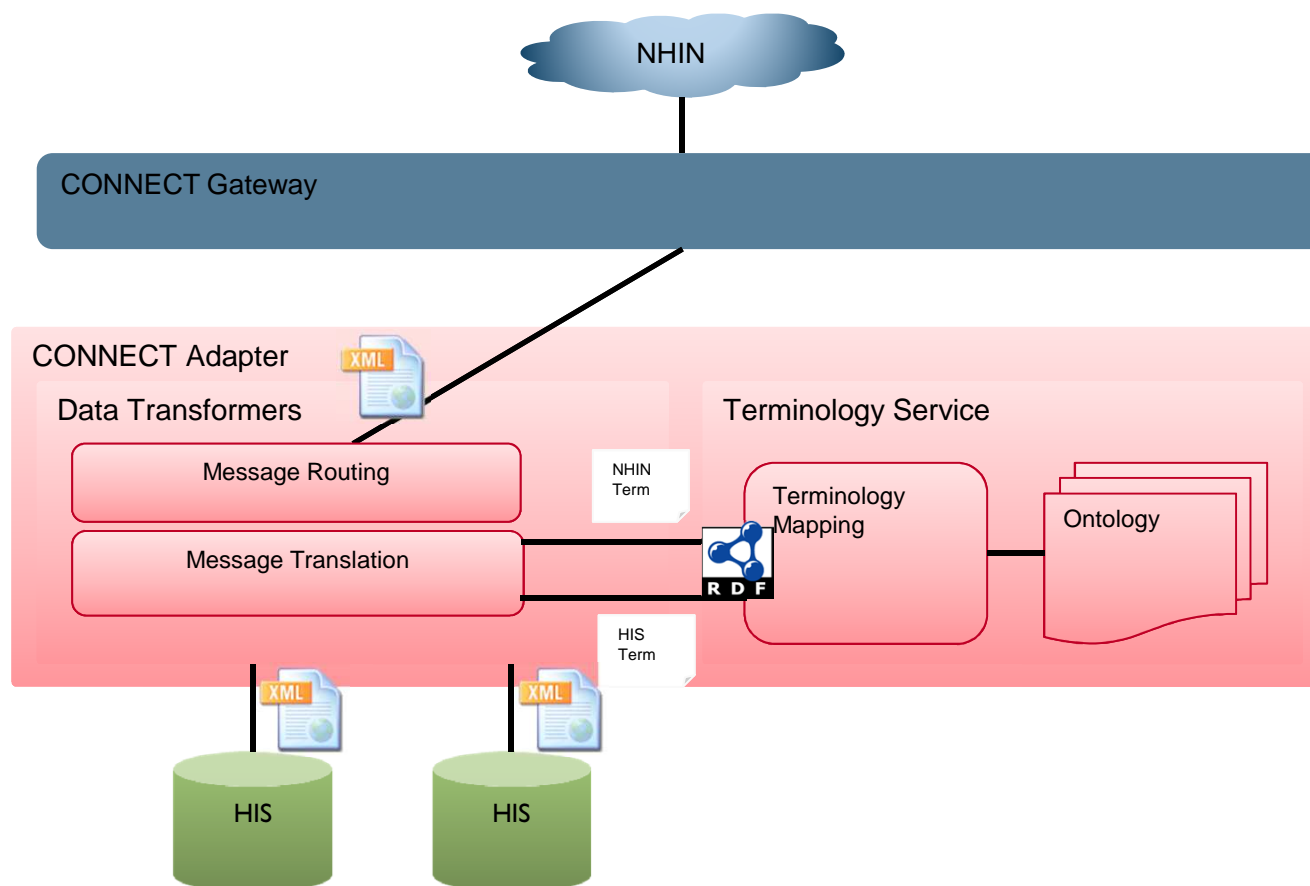
# Leveraging Semantic SOA in CONNECT Adapter



Semantic Enhancements  
would be in the common SDK  
services



# Challenges in Implementing CONNECT Adapters





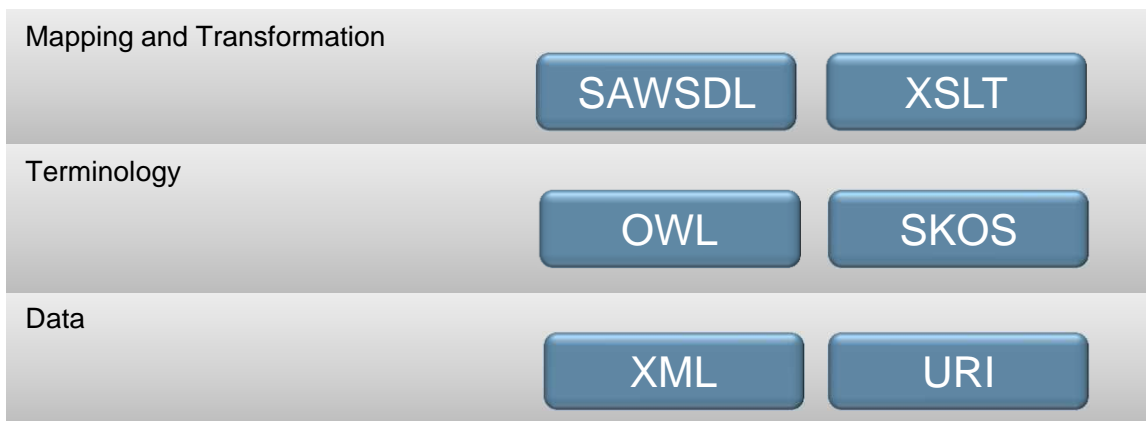
## Key Benefits

- Improved change management
  - Change is made only declaratively at the Ontology level, not multiple times in each adapter's code. Currently if a data element changes, each adapter's code would have to be modified and a new version deployed.
- Future enable the HIS
  - As new standards, like the new Universal Data Exchange Language proposed by Office of the National Coordinator (ONC), emerge and are adopted, the adapter doesn't have to change, only the new standard has to be mapped to the Ontology.
- Intelligent Search across the organizations systems
  - Ontology based queries can span all mapped data elements and also federate across other systems.



## Open Standard Compliance

- Web Ontology Language (OWL)
- Simple Knowledge Organization System (SKOS)
- Semantic Annotations for WSDL and XML Schema (SAWSDL)
- Extensible Stylesheet Language Transformations (XSLT)





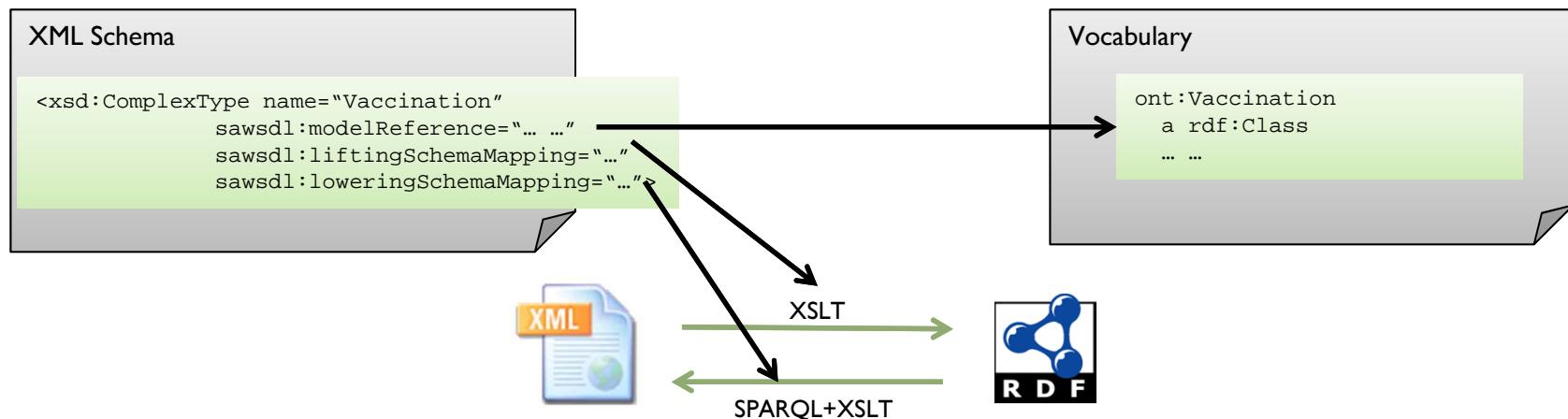
## Concepts and Terminology

- HL7 and other Physical Models describe the representation structure that actually contains the data
- Ontologies help describe the Logical Model, the entities, their relations, and their properties
  - The Web Ontology Language (OWL) is used to represent ontologies and represent constraints on data structures. It is generic but can be used to represent well defined semantics
- Simple Knowledge Organization System (SKOS) is an application of RDF/S and OWL to express controlled vocabularies and thesauri classifications in a distributed and linkable way
- The usage of Semantic Terminology services can help reduce the chasm between content ontologies and message exchange formats



# Semantic Annotations for WSDL and XML Schema (SAWSDL)

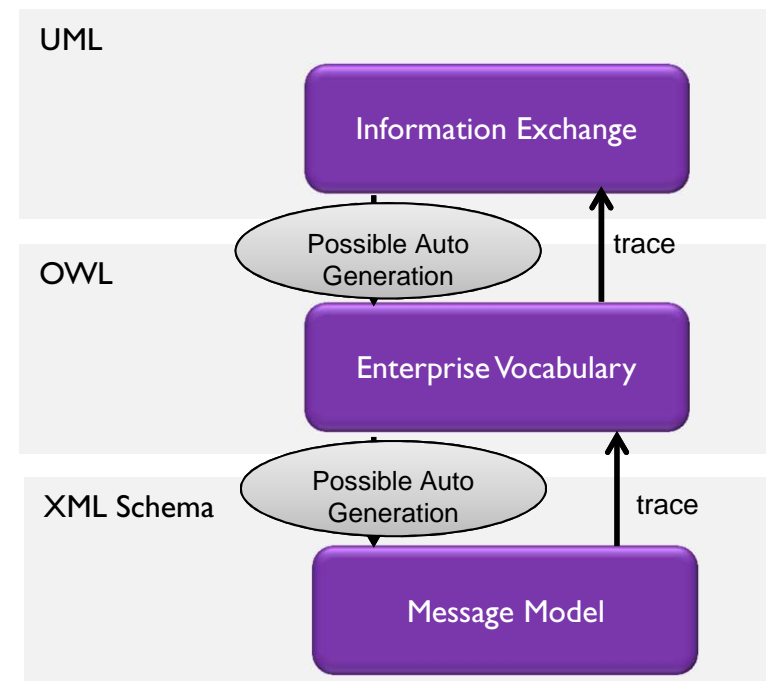
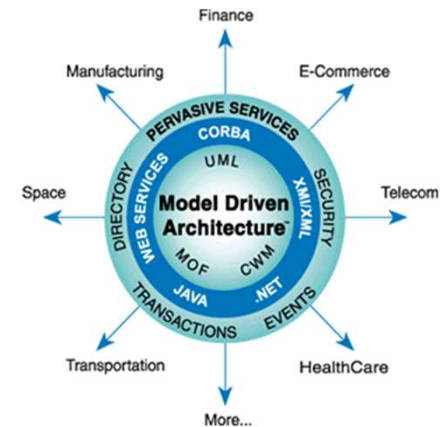
- Relate the Service and Message description to the meaning captured in an Ontology.
  - Annotations can be applied to all WSDL elements and XML Schema types.
- Define transformation between wired message format and the ontology representation.





# Semantic Mediation and Model Driven Architecture

- Business concept and information exchanges identified independent of technologies
  - Engaging subject matter experts
- Ontologies as platform independent representation of the information
  - Leveraging knowledge within the community
- XML Schema as platform specific implementations
  - Additional level of abstraction eliminates the need to map between individual XML schemas







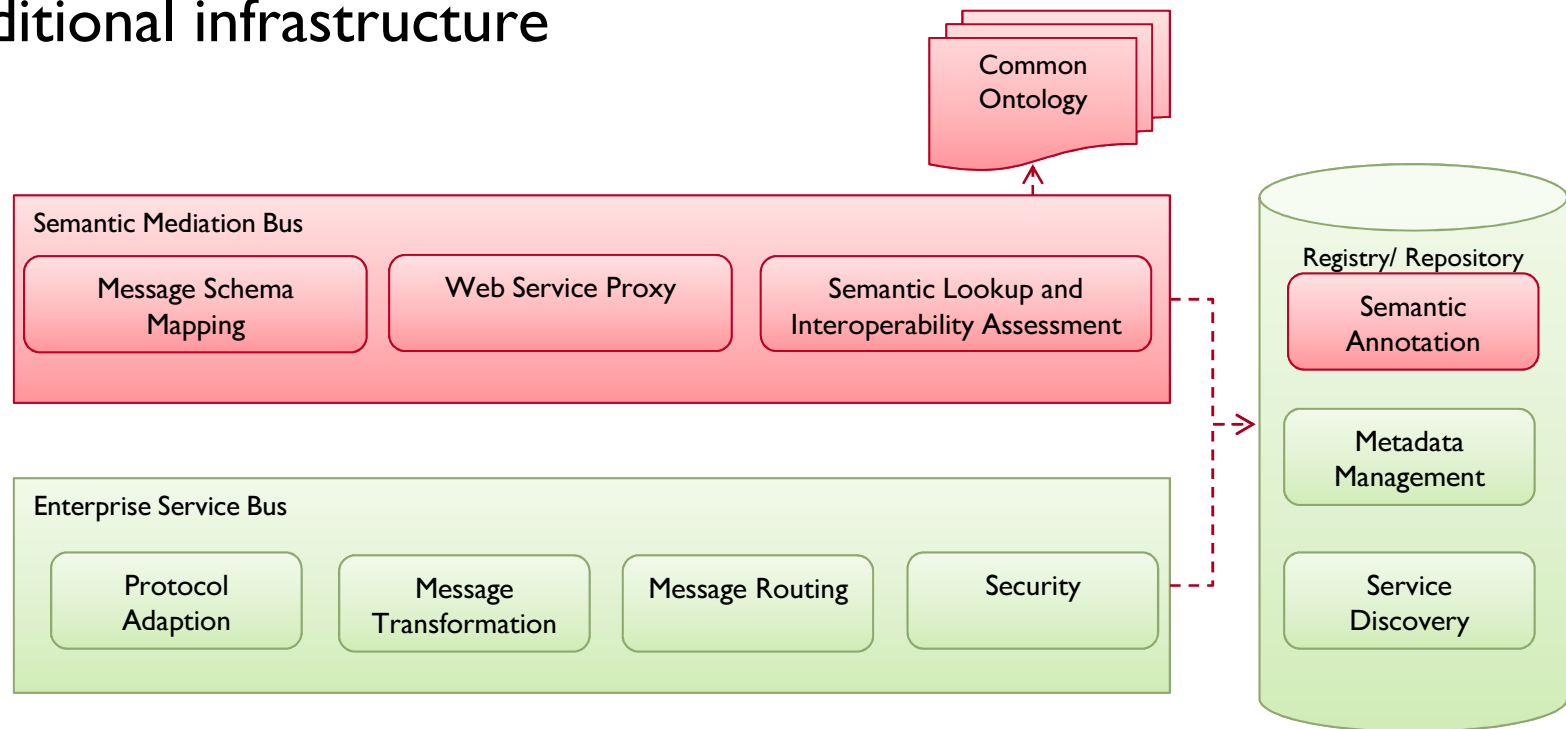
## Semantic Mediation in the Enterprise (Beyond CONNECT)

- Challenge: Data integration is as much an issue as in the inter-organizational context
  - Data mash up solution from disparate systems
  - Incorporation of unanticipated sources in business intelligence
  - Enhancement of situational awareness through on-demand integration of data
- Opportunity: Ontology is not only a tool for understanding, but also a basis for executable solutions



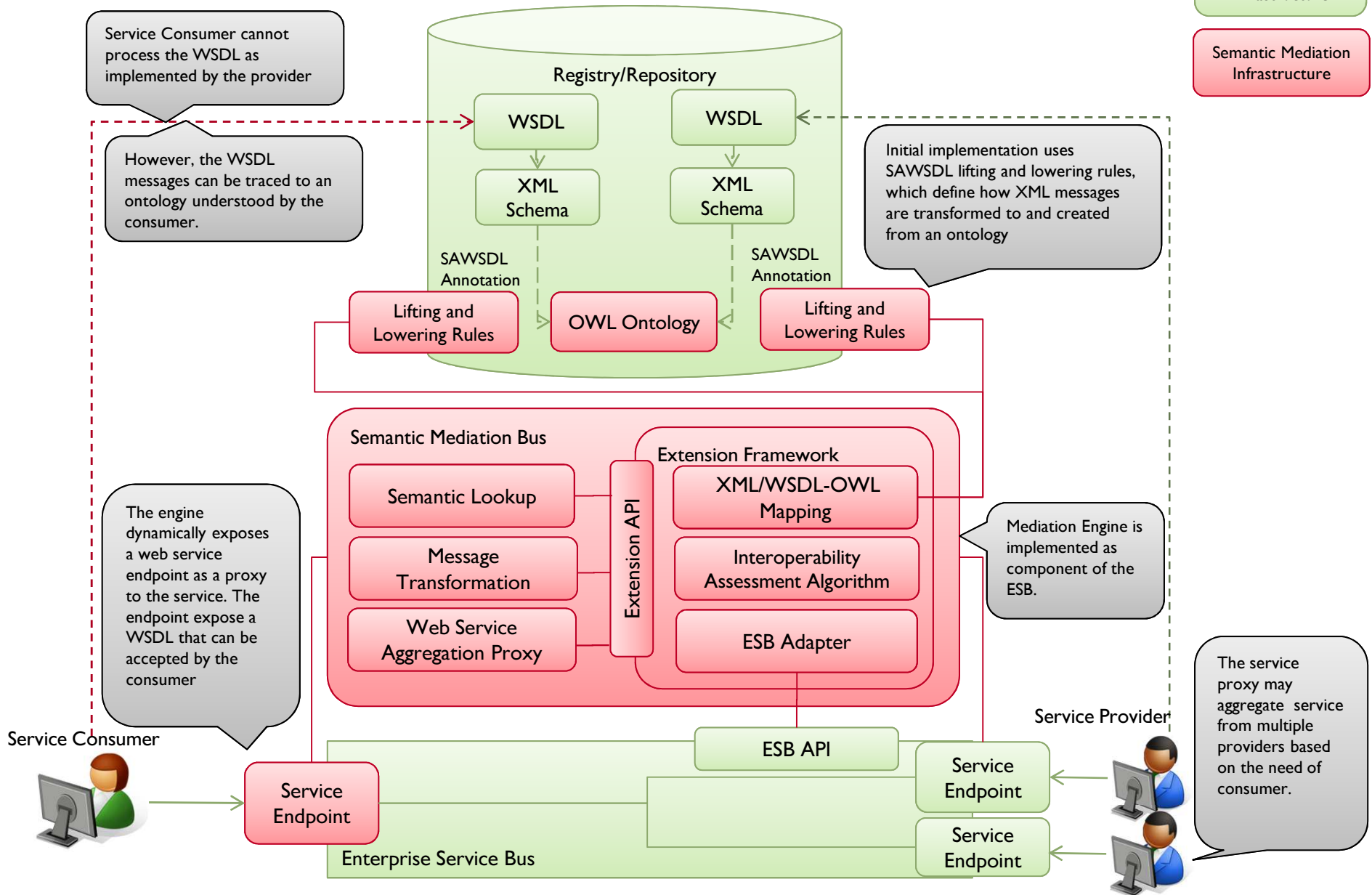
# Semantic Mediation Bus

- An ontology-based web services mediation bus that enables services with different message formats to interoperate
- Implemented as a thin semantic mediation layer on top of a traditional infrastructure





# Semantic Mediation Bus





## Summary

- Re-usable transformation
  - As new systems are brought online or new entities are added, they can be expressed with the ontology, allowing the transformations to be reused
- Better understanding and visibility of the data elements within the organization.
  - This in turn improves communication and knowledge sharing
- Visibility of the relationships between similar entities in different systems.
  - The inference systems based on ontologies can discover hitherto unknown relationships



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