Business Case for Service Oriented Architecture

Presented by

Information Technology International, Inc.
And
OntoReason LLC

Presenters

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  - Member HL7
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Who is ITI Inc.

- ITI is a Software Vendor that provides Public Health Information Systems to State and Local Health Departments
- ITI's product line is developed using a service-based architecture implemented on HL7 RIMM
- Our Products include:
  - NEDSS implementations
  - Electronic Lab Test Reporting
  - Provider Portal for Public Health Reporting
  - Security Subsystems
  - Information Integration Systems
- We are deployed as a component of our customers enterprise solution interacting with many information sources and legacy systems

Who is OntoReason

- OntoReason LLC is a partnership of IT and Health professionals formed to create state of the art tools for use in Health Care Information Systems

- OntoReason LLC product line includes:
  - Chi Standards-based Public Health Ontology
  - Forward and Backward chaining Reasoning Engine
  - Standard Services-based API

- Initial Product Features Include:
  - Code Set Translation/Standardization
  - Concept Generalization/Specialization
  - Differential Diagnosis
  - Standard Differentiation Questions to Narrow Diagnosis
  - Case Definition and Status Determination

- Next Generation Product Features Include:
  - HL7 V3 Message Segment Creation
  - Vocabulary Management

Discussion Outline

- Introductions
- Service Oriented Architecture Definition
  - What and Why
- Technical Overview
  - Basic technology definitions
- Business Case Scenarios
  - Examples from the ITI Deployment
  - Value of Service Implementation
- Discussion of the OntoReason Service implementation
- Defining a Services Strategy
  - Moving Forward
- Discussion

Service Oriented Architecture

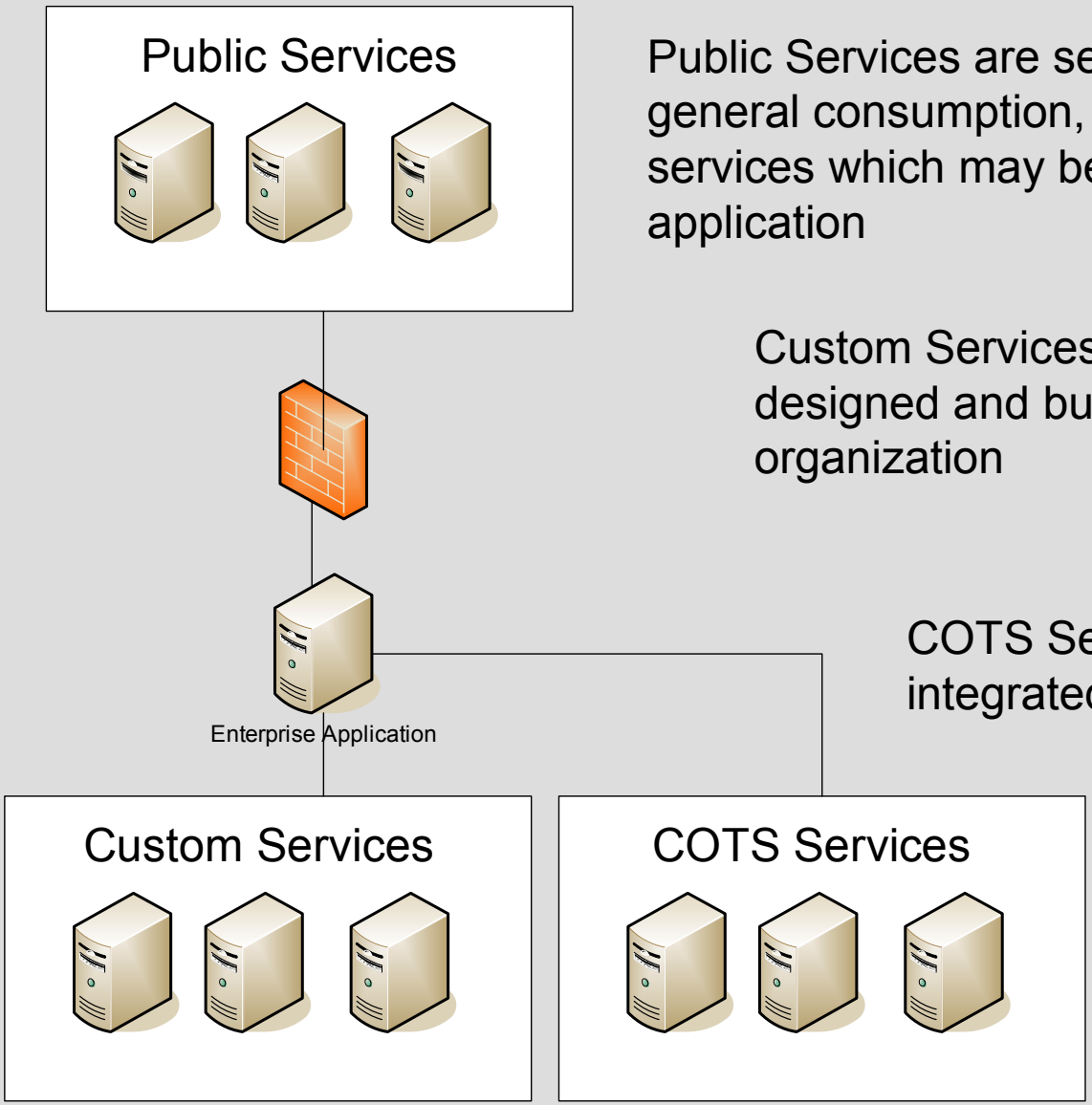
Defining Services and a Service Oriented Architecture

Services Oriented Architecture Definition

A service-oriented architecture is a collection of services designed to work together to support multiple application functions, and perhaps multiple applications.

- To understand SOA you must understand what a service is:
  - Services are not a new thing. Technologies such as DCOM and CORBA have been used to support services for quite some time
  - A service is a self-contained system that provides an independent application function to clients

Sources for Services

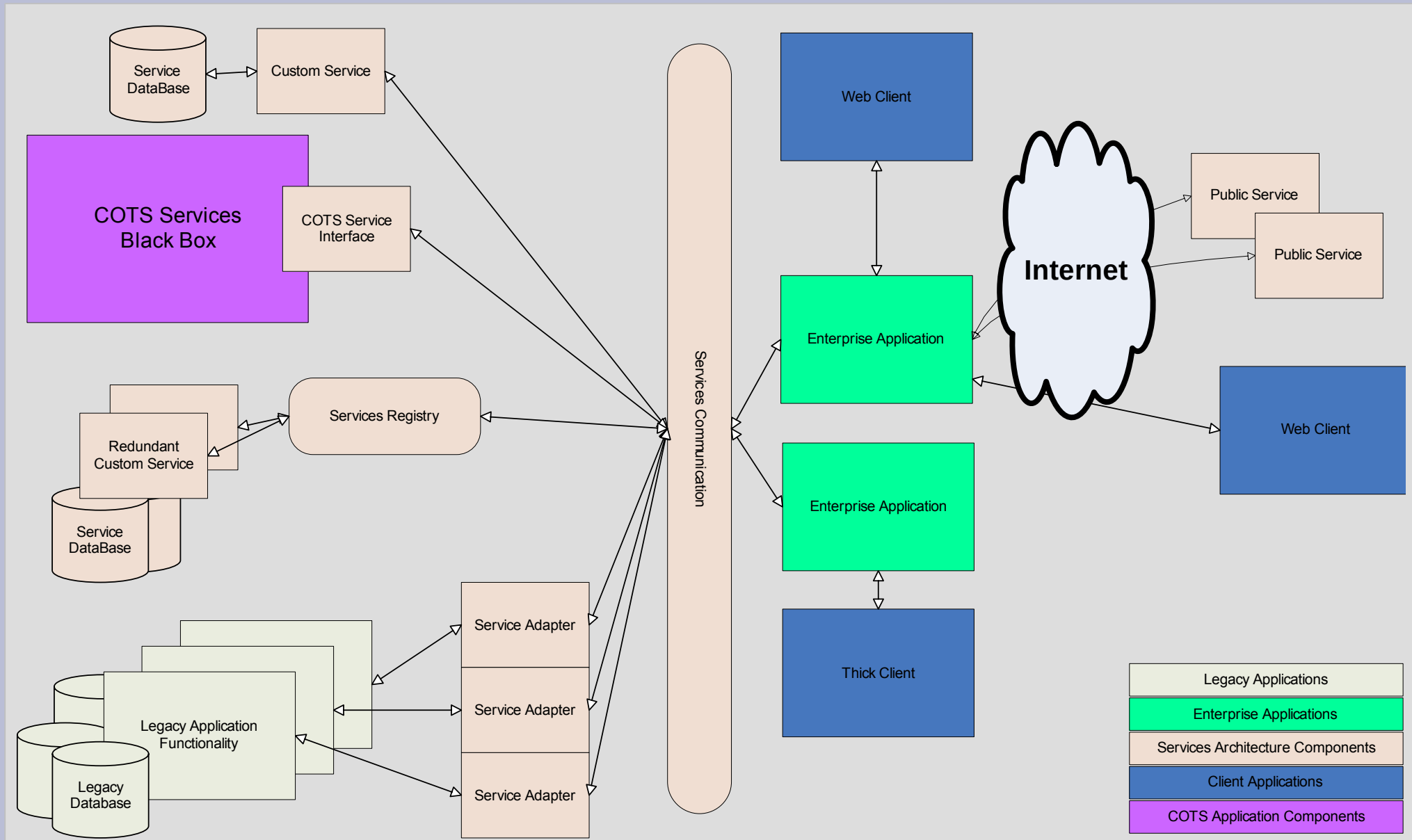


Public Services are services which are free for general consumption, and provide generic services which may be of value to a given application

Custom Services are services which are designed and built within the applications organization

COTS Services are licensed services that can be integrated into application structures

General Services Architecture



Service Technology

- Common Service Architectures
  - DCOM
  - Corba
  - EJB
  - Web Services
- Architecture Limitations
  - Some are Platform Specific
  - Some are Language Specific
  - Some are Complex/Difficult to implement

Web Services as a Solution

- Web Services – Advantages
  - Service Architecture based on existing “Web” technology and protocols
    - http
    - ftp
    - Email
  - Often implemented using standard web server technologies
    - Web Servers - Apache, IIS
    - App Server – J2EE, .NET
  - Web Services deployed on almost all platforms and languages
  - Works within common network configurations
- Some potential Web Service Limitations
  - Un-optimized message structure
  - Use of common protocols may exposed otherwise secured systems

Web Services

- What is a web service
  - A web service is a service technology that utilizes standard Internet technologies as the communication technology
- Web Service Technologies
  - SOAP
    - Simple Object Application Protocol
  - WSDL
    - Web Service Description Language
  - UDDI
    - Universal Description, Discovery, and Integration
  - ebXML
    - Electronic Business using eXtensible Markup Language

Service Oriented Architecture

Services Satisfying Real Business Requirements

Objectives for Service Implementation

- Provide consistency of function between applications in an enterprise
- Provide a platform to leverage existing functionality in additional applications
- Provide cross platform functionality with different operating systems and languages
- Reduce overall implementation costs when compared to implementing features within existing applications

Business Scenario Review

- The scenarios reviewed were selected from the current Public Health Surveillance application installed for the state and many of the county public health jurisdictions in the state of California
- Specific scenarios were selected to demonstrate the value of utilizing Service Oriented Architectures are part of an Enterprise level application
- Scenarios demonstrate the use of services for integration of applications from different vendors, internal service implementations for shared functionality, and the use of COTS services.

Applications :
Information Technology International, Inc.

- ITI provided the PHS3 application and integration services for the implementation of a NEDSS compliant application.

- The PHS3 application provided application function for :
  - Electronic Lab Test Processing
  - Public Health Case management for Local Health departments
  - Local to State reporting of qualifying Public Health Cases
  - Preparation and processing of Public Health Cases for reporting to the CDC

- The PHS3 application suite is a J2EE based set of applications and services

- The PHS3 SOA is based on Web Services designed to function within a Intranet/Internet environment

- PHS3 utilizes SOAP and Hessian (Java native web service framework)

Applications : OntoReason

- OntoReason provided Public Health information resources and services
- The OntoReason Public Health Ontology provided the following functions :
  - Vocabulary Services of standard code systems used for Lab Tests, Micro Organisms and Condition Identification
  - Code translation services to help perform translations from legacy code values to standardized code systems
  - Reasoning Intelligence for identifying case reporting requirements

Applications :
Global Secure Services

- Global Secure Services provided application functions to the state of California
- Application functions include
  - Single Sign-On Intranet Solution
  - Application Portal Gateway
  - Alerting and Notification system

Implementation Architecture using Web-Services

Business Scenarios

- Single-Sign-on / Application Portal
- Address Validation
- Electronic Lab Test Procession
- NEDSS Case Definition

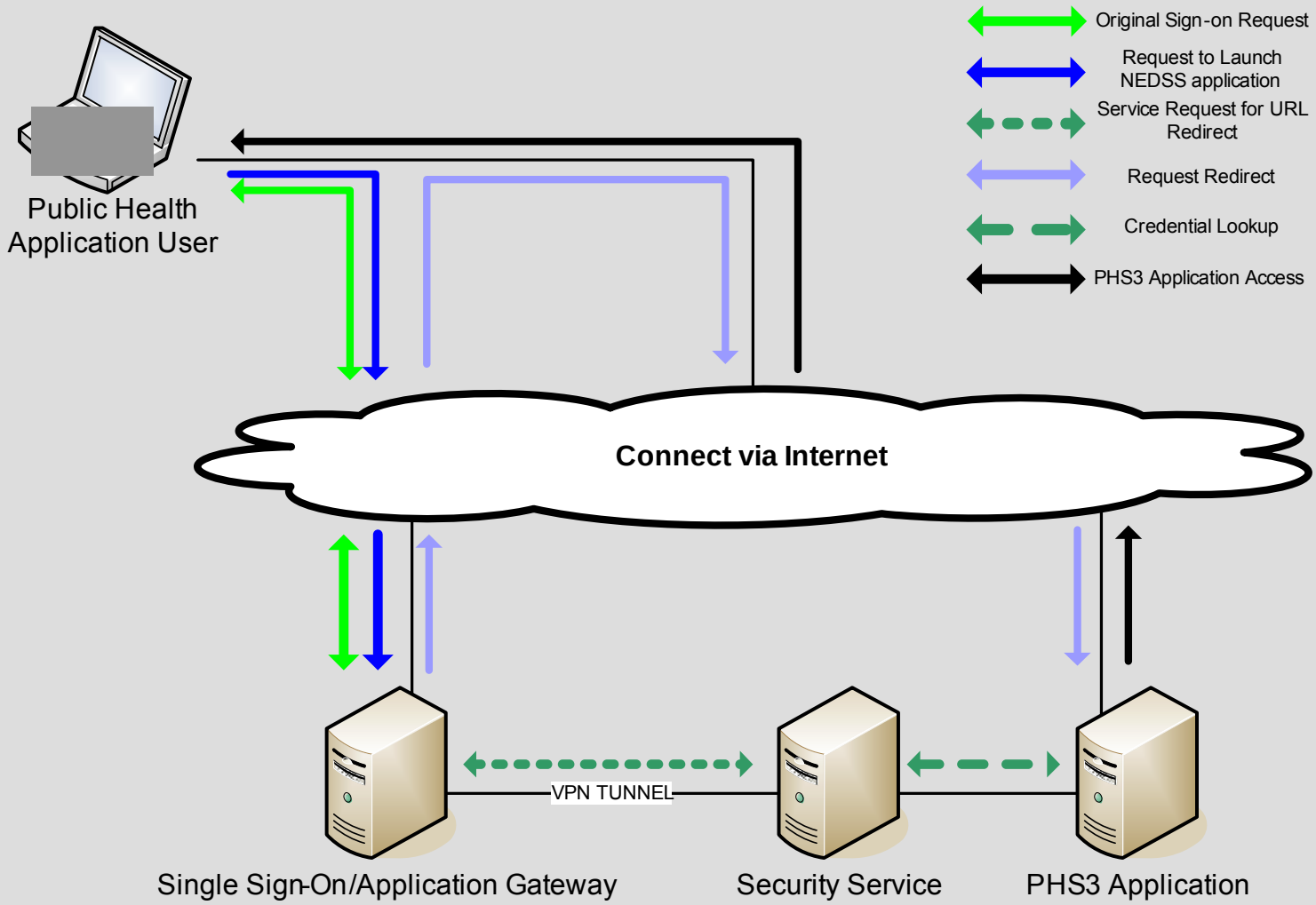
Business Scenario 1
Single Sign-On/Application Portal

- Customer had a Single Sign-On system for web based applications that was limited to supporting applications within the local network domain
- Single Sign-On system could not support full request proxy, requiring client applications to directly access each application directly
- Application requiring this support is a state wide application used by a fairly large number of users
- Security information gathered by the original sign-on needed to be passed to supporting application
- Implementation of additional infrastructure was outside of both project time table and budget

Scenario Solution Using A Service

- Customer provided a limited bandwidth connection directly between the portal network and the application network.
- A VPN was created between these two networks using existing technology (Microsoft VPN solution)
- A Service was created that provided to the sign-on applicaton a function that would accept user credentials (primarily the userId) and returned the URL of the surveillance application to be secured. Embedded in the URL was a key.
- The Single Signo-On application called the service whenever the user selected the surveillance application from the application menu, then called the service, and sent a redirect to the URL location to the users browser.
- The Surveillance processes the request, and isolates the key. It then calls the original service providing the key, and the service returned the user credentials. Those credentials are then checked against the application “users”, and if found, the application allows access

Security Service



Value of Solution to Customer

- Solution did not require any additional infrastructure other then the limited network connectivity and the VPN. This connection is provided over the Internet
- Software development costs were fairly low, and promised to not add significant long term recurring costs.
- Solution used a SOAP based interface which made it simple to implement in an environment where the portal application was written using Microsoft Technologies, and the Surveillance application was written in Java.
- Solution was flexible enough to be reused in additional situations with configuration changes.
- Reduces administrative support requirements for all state surveillance application (2-3 support engineers)
- Reduces complexity of 1000+ users needing user names and passwords for more than one system, plus enables two factor security to be implement state wide.

Business Scenario 2
Applications Requiring Address Validation

- Various applications required a function that would validate addresses entered by users and received from outside sources
- Address Matching System from USPS provided a solution for this function. The AMS system provided an API for performing validation
- Data and API are updated by USPS 6 times a year, with licensed code that required update to continue working
- Cost of multiple implementations, along with associated maintenance costs suggested that a service could be used

Solution Using a Service

- The USPS Application provides a native API callable within various application platforms, written in C++
- Since multiple applications required this function, a service was built that provided a simplified API via SOAP and Hessian
- Applications can call this service with an address record to be tested, the service returns a corrected (normalized terms and corrects) address or a collection of possible corrected address

Address Validation Service

Value of Service to Customer

- The USPS database is provided on CD and must be installed every two months
- Applications must be updated, as the software and database expire
- With the service, multiple applications can be maintained from a single location, with down time only being for the installation of the new version of data.
- Customer receives both tangible savings in time for both implementation and support, as well as consistency of operational data
  Provides consistent address validation to the enterprise, where 70% of the address information across the enterprise contains some error, with missing information

Business Scenario 3
Lab Test Processing

- Customer implementation of an Electronic Lab Test processing system had state wide reporting of lab tests to a single location in the state.
- Lab tests sent from various facilities in various HL/7 formats (2.3, 2.3.1, 2.3.7, 2.4) and non HL/7 formats (fixed length formats and comma separated value format)
- Lab Test information needed to be standardized to a single HL/7 format
- Messages need to standardize on coding systems for lab information (LOINC and SNOMED)
- Messages need to be distributed to various locations based on location and related condition

Solution Using Services

- The solution to this problem involves a number of supporting services provided by ITI, OntoReason and the CDC
  - Public Health Ontology
    - The Public Health Ontology was used to provide vocabulary services for translation of various standard codes systems to SNOMED and LOINC
    - Service was also used to identify conditions and condition groups to help determine routing information for messages
  - Jurisdiction Resolution
    - ITI provided a Jurisdiction Resolution service that translates address information into the identification of jurisdiction of record responsible for a given lab test
  - PHIN/MS
    - One of the communication structures supported by the solution is the ebXML powered PhIN/MS application
  - Lab Tests delivery
    - Lab Test information was pushed to the NEDSS application via a web service for processing
- Services implemented using SOAP, ebXML and Hessian technologies

Lab Testing Processing Service Architecture

Value to the Customer

- Overall implementation coordinated applications so each implementation was simple and specific to the problems that were solved

- Service Reuse
  - Jurisdiction Resolution : The jurisdiction resolution service is utilized by other applications within the enterprise. Specifically, the main NEDSS application and an Internet facing Provider Portal uses the function to properly identify case responsibility within the state.
  - Public Health Ontology : The vocabulary service is used by the NEDSS application to provide valid conditions, tests and organism values for processing

- Implementation costs
  - Utilizing existing services and COTS solutions, overall cost for implementation was minimized and shared between projects

- Time to implement
  - New organizational structures can be implemented within a few hours, allowing regional studies, new reporting jurisdictions, and the implementation of a new organization within a week.
  - New and emerging conditions can be added to our surveillance management solution within a few hours. Changes and modification of existing condition management can be done in minutes.

Business Scenario 4
NEDSS Case Definition

- Various components of a NEDSS implementation require proper case definition information
- Reporting requirements must be analyzed to insure that all case information is enter correctly
- Constancy of data within the application and communication with other components
- Vocabulary information for coding data within the application

Solution Using Services

- Implementation of the OntoReason Public Health Ontology as a service
- The Ontology provided the necessary vocabulary information for presenting both lab test information and organism codes using recognized coding standards for code systems and data types
- Condition definitions organized valid tests and organism so that proper processing within the NEDSS application could be performed
- Case Definition information provides informational content about certain conditions
- Business rules derived from Ontology used to insure that case information is properly completed

NEDSS Case Definition Service

Value to Customer

- The use of the OntoReason ontology provides a flexible extensible solution to enhance core behaviors
- Use of standards help insure compliance
- Standardization of applications within the enterprise structure
- Enables changes to the business logic without modifying software
- Enables the separation of complex business logic from core application. This allows specialized logic to be implemented as a service that can be used across the enterprise. For instance the surveillance module and the Lab Reporting module.
- Cost of implementing change in system is minimized, as chances can centralized, where if these features were embedded and used in multiple applications each application would require change.
- Minimize cost of expanding total system
- Separates complexity of domain model from core application

Defining a Health Ontology

Ontology *: An explicit formal specification of how to represent the objects, concepts and other entities that are assumed to exist in some area of interest and the relationships that hold among them.*

- The OntoReason ontology represents various components of the public health in HL/7 terms and data types
  - General Coding Systems
  - Lab Test Information
  - Micro-Organism
  - Related Signs and Symptoms
- Abstractions of the ontology are be combined with rule based inference engines to provide logical processing

OntoReason Architecture

- The OntoReason tool set is generic and can be applied to many different problem sets within the health industry. Public health has been our initial target and this is reflective in the initial set of features. It is anticipated that a much broader set of services will be provided as the product matures.

Core Ontology Services

- Vocabulary Management
- Message Segment Creation
- Code Set Translation
- Concept Generalization
- Concept Specialization
- Case Definition

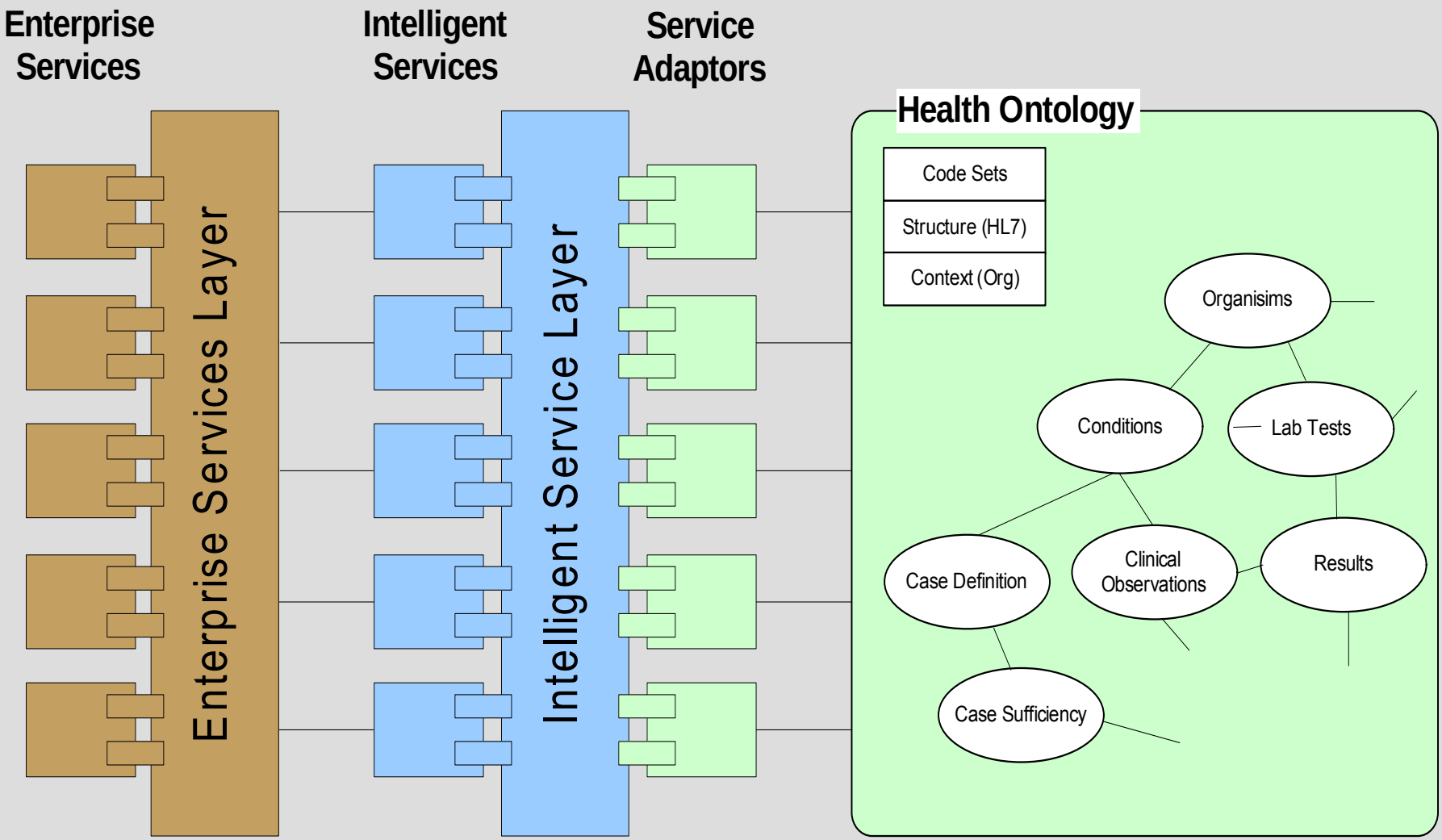
Core Reasoning Services

- Data Association and Correlation
- Differential Diagnosis
- Investigative Reasoning, Data Collection Requirement Definition, and Task Prioritization
- Contextual Reasoning within an Organizational Scope
- Case Status Definition
- Cluster, Outbreak, and Pandemic Indicators

Core Enterprise Services

- Intelligent Meta Services Broker, Services Bus, and Message Handler

OntoReason Architecture



Using Ontology Based Services to Solve the NEDSS business Problems

- PHS3 implements the NEDSS architecture which demands adherence to key business requirements
  - Standardization of coding systems
  - Standardization of information representation
  - Standardization of communication

- The Ontological view of the public health information in the OntoReason knowledge system provides PHS3 with significant support in satisfying these goals

- By not requiring ITI to develop and expand this information independently, ITI and its customers have saved both in general implementation costs, and information accuracy

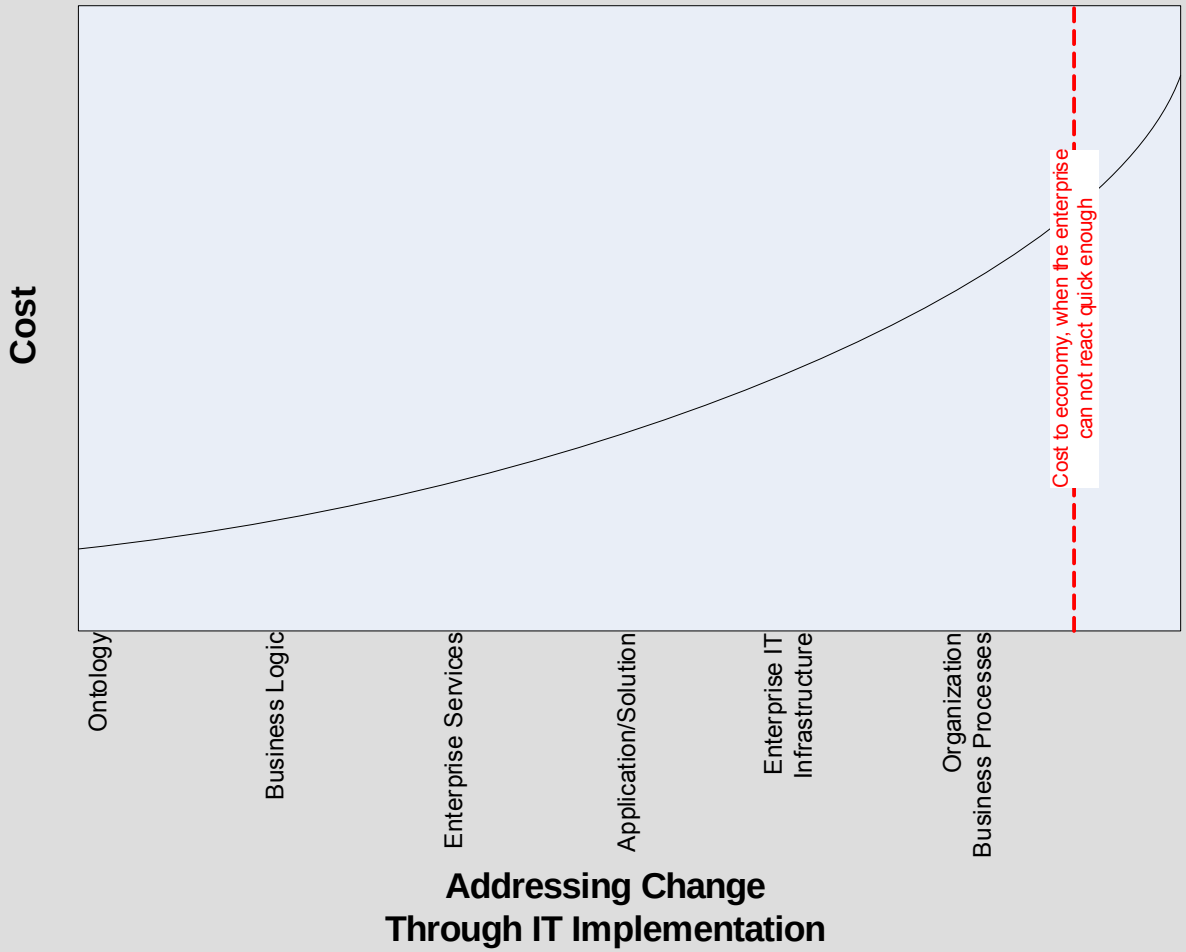
Service Oriented Architecture

Addressing the Value Proposition of Service Oriented Architecture

SOA Value Proposition

- By addressing these problems with services, we have realized the following advantages:
  - Services improve the ability to respond to a changing landscape of both IT and business problems
  - Services give single point of change to reduce costs when updates are required
  - Services can extend the value of existing legacy data and systems
  - Services can provide integration between third party applications to build enterprise wide solutions
  - Services provide for enterprise standardization of both data and processing function

Value Proposition for SOA



In public health, inability to respond to emerging conditions can create costs outside of the public health organization, and have a direct cost to a communities economy.

Examples include response to SARS, West Nile and Avian Flu.

Countries have paid the price in lost tourism, agriculture devastation, and excessive public monitoring.

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