SOA and Systematic Reuse for Health Information Exchange Systems

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Date	14 July 2010

From Last Year

SOA in an Electronic Health Record Product Line

- Introduced product lines and SOA solutions
- Highlighted an agile modeling approach

For SOA

- create services for use across applications and practices
- support reuse through reusability that is built in
- lay ground for development of multiple, related systems (i.e., product line) from core asset base of services

Goals of this Presentation

Highlight the mutual benefits of combining service oriented and product line approach

- flexible approaches for implementing business processes in an SOA with
- systematic reuse approaches from software product line (SPL) development.

Explain a combined SOA-SPL approach in which

- developers build core assets, including services
- construct systems through the systematic reuse of these core assets in a predefined way

Define systematic reuse for SOA

- Developers exploit commonality across related products
- Apply planned variation among core assets
- Use SOA for flexibility – variation through services that are not bound to a specific product.

Approach

Define software product lines and service oriented architecture

Show advantages of combining them

Compare and contrast SPL and SOA

Show example

Explain application of combined SPL/SOA to example

What’s Meant by SOA and Product Lines

Definitions:

- A software product line (SPL) is a set of software-intensive systems that share a common, managed set of features that satisfy the specific needs of a particular market segment or mission and that are developed from a common set of core assets in a prescribed way [Clements 2001].
- A service-oriented architecture (SOA) provides a way to design, develop, deploy, and manage systems characterized by coarse-grained services that represent reusable business functionality and service consumers that compose applications or systems using the functionality provided by these services through standard interfaces [Lewis 2008a].

Merging the concepts:

- For service-oriented systems development: approach for managing variation to identify and design services targeted to multiple service-oriented systems
- For SPL systems: approach for managing variation where services offer variation mechanisms within a product line

Aspects to Consider in a Software Approach for Developing Multiple Systems

Scope of applications

Design approach

Source of variation

Application target

Compositional elements

Technical approach

SOA and SPL

Aspects	Definition of an SOA	Definition of an SPL
Scope	*	A set of software-intensive systems
Design approach	A way of designing systems	**
Source of variation	*	that share a common, managed set of features
Application target	to implement business processes	satisfying the specific needs of a particular market segment or mission
Compositional elements	composed of services	and that are developed from a common set of core assets
Technical approach	invoked in a standard way	in a prescribed way

* not explicit in the definition

** not explicit in the definition but captured in the technical approach

Example SOA-Product Line Example

Explore reuse challenges of health information exchanges (HIEs)

- deal with a variety of customers across a diverse market
- accommodate an ever-changing set of interface and data exchange standards

To manage product variation and scope for HIE system, organizations must:

- address customer specifics and integrate with third parties
- quickly deploy partial system or deploy existing systems to new platforms
- extend capabilities to address emerging national data exchange standards

Recommendations based on Siemens experience*

* http://www.splc.net/prev-conferences/soapl-2008.pdf

What’s a Health Information Exchange*

“Electronic mobilization of health information across organizations and disparate systems within a region or community.”

Goals of HIEs

- support interoperability
- facilitate access to and retrieval of clinical data,

How is information exchange achieved

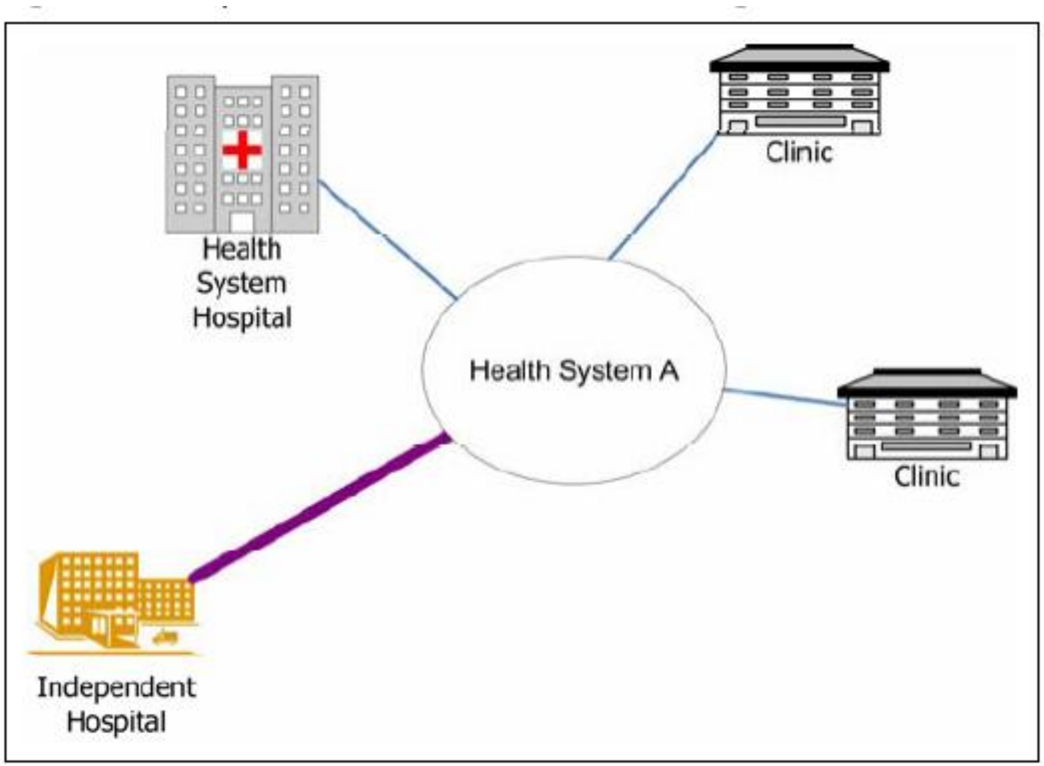
- privately and securely
- provides safer, timelier, efficient, effective, equitable patient-centered

Used synonymously with

- Regional Health Information Organization (RHIO) and
- Health Information Network

* Research Triangle Institute. *Interim Report on Solutions to Barriers to the Electronic Exchange of Health Information,* 2007. http://www.health.state.mn.us/e-health/mpsp/mpspsolrpt011707.pdf

Simple HIE Model



Characteristics of Simple Model

Organizations maintain data on own systems

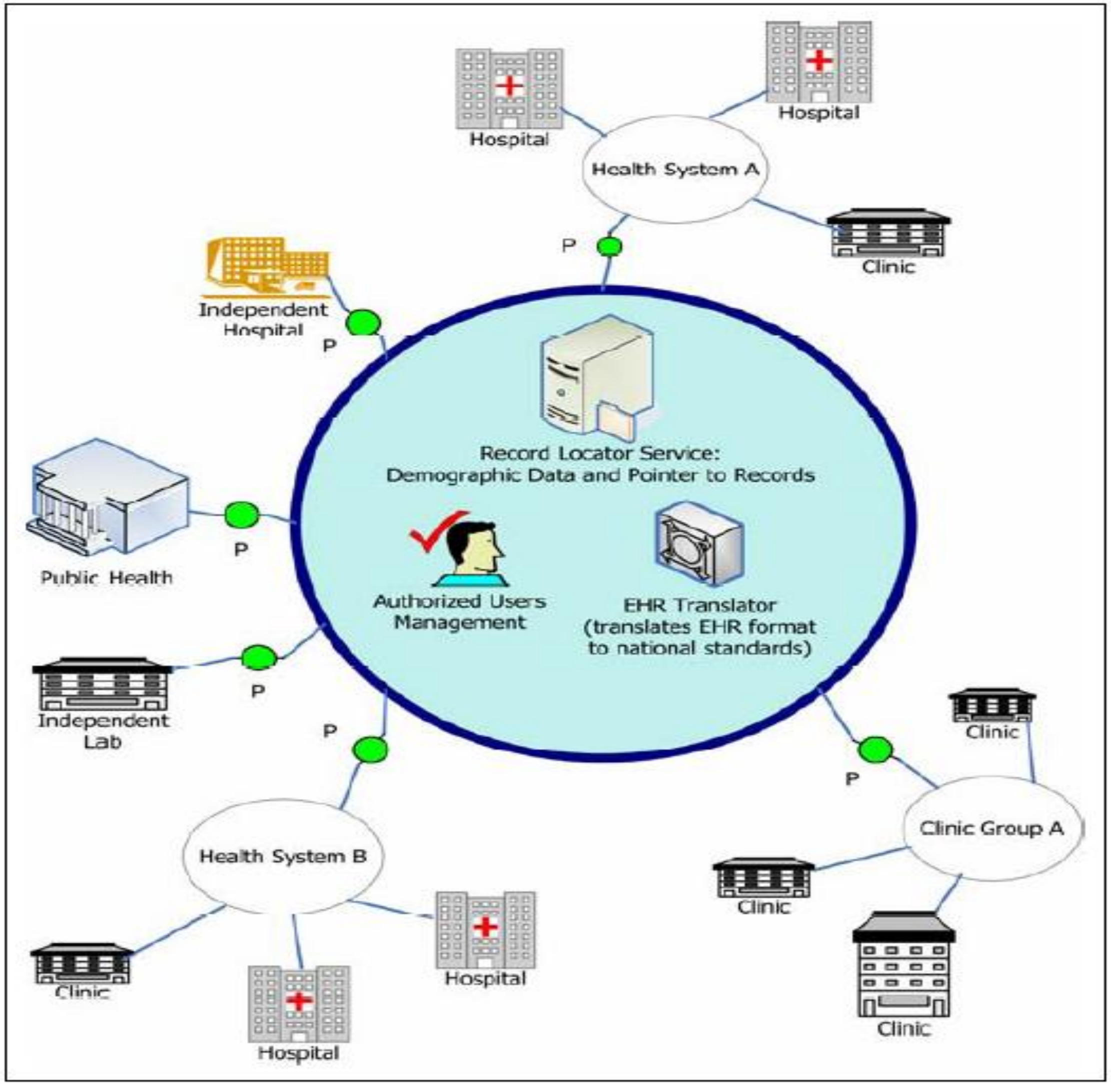
Organizations coordinate user authorization and access directly

No centralized patient record locator service – identification is coordinated between the organizations

Variations in electronic health record access

- Full read/write access
- View only access
- Clinical message exchange (care record, medication history, etc.).

Complex Model



Characteristics of Complex Model

Decentralized Data – organizations maintain own data on own systems;

Centralized coordination for

- user authorization and access
- patient identification through record locator service (demographic data, pointer locations of patients' clinical data)

- Portals provide access to the electronic health
  - Medical history
  - Medication history
  - Continuity of care documents

Recognize commonality and variants across HIE systems

Example HIE Needs:

- *compartmentalized access to patient data depending on the organization or user*
- *patient locator service or localized patient identification*
- *EHR format translations*

SOA-SPL approach:

- Identify services from legacy components or capabilities for use by existing or potential applications.
- For applications requiring slight variations, scoping process employs product line approaches to identify the service features that are common across all the products.
- Organization engineers variations or variant services to accommodate the products’ unique features.

Leverage commonality by building core assets, including services, across the variants with established points of variation.

Example HIE Needs

- *Core asset variation to support different health systems, clinics, hospitals, and labs*
- *Variations to manage different levels of health record access*

SOA-SPL approach:

- Package services as core assets with selected features.
- Employ service invocation as a product line variation mechanism.
- Identify variations that will lead to change in scope or that can respond to new or changing market conditions. They can easily adapt to changing needs or to the identification of new products based on an existing core service asset base.

Address the enterprise integration needs that service-oriented systems must offer

Example HIE Needs:

- *Integration with an external service*
- *Interoperate across integrated systems*

SOA-SPL Approaches:

- Use services as variation mechanisms to support enterprise integration.
- Meet variations across enterprise through implementations with different variants or with implementations that integrate with external services.
- Use SOA-SPL connection to reduce integration time for connecting parts of the system to each other and to external systems.
- Use SOA-SPL in enterprise integration to encompass many different sets of systems and product lines, enabling SOA integration mechanisms to share services across divergent systems in a context-independent fashion

Address end-user needs for variation within service-oriented systems

Example HIE Needs:

- *User variation to accommodate unique work flow*
- *Personalized user interface needs*

SOA-SPL Approaches:

- Identify features and an implementation of variability at the end-user level.
- Expose product functionality as services.
- Enable the workflow-based composition of services using a variation mechanism to accommodate site-specific requirements.

Summary

Combine existing SOA and SPL approaches for variation management

- encourages an organization to reuse existing assets and capabilities rather than repeatedly redevelop them for new systems
- enable organizations to capitalize on reuse to achieve similar business goals regarding software-reliant systems

Meet business goals by

- managing variation to identify and design services targeted to multiple service-oriented systems
- managing variation where services became a mechanism for variation within a product line or for extending product line scope

References

[Clements 2001] Clements, P. & Northrop, L. M. Software Product Lines: Practices and Patterns. Addison-Wesley, 2001.

[Lewis 2008a] Lewis, Grace A. & Smith, Dennis B. Service-Oriented Architecture and its Implications for Soft-ware Maintenance and Evolution. http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=4659243&isnumber=4659234 (2008).

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