A Systematic Approach for Migrating to SOA

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Agenda

Healthcare IT Challenges

Basic Concepts of SOA

Migrating Legacy to SOA

SMART: Basic Approach

SMART- AF (Adoption Feasibility)

SMART – ESP (Enterprise Service Portfolio)

SMART – MP (Migration Pilot)

- Laboratory Information System example

Summary

Is Healthcare IT Unique?

Some business issues are unique

- Unique business processes and data
- Heavy regulation
- Large variety of stakeholders: hospitals, patients, providers, insurance companies, suppliers, research institutions, regulators, …

Some are general problems that are faced by every domain

- Defining and modeling essential business information and business rules
- Storing and accessing information in support of business processes
- Assuring security, performance, availability and usability of IT systems
- Applying appropriate technology to solve business needs

The challenge

- Apply general software engineering principles to specific problems of healthcare
- Determine applicability of SOA to healthcare business and IT demands

Healthcare IT Challenges

Current healthcare business and IT demands

- Create consistent lifelong patient health record that can be shared between multiple healthcare providers
- Assure security and identity management
- Enable vastly different systems to work together
- Enable evolution to new healthcare alliances and to rapidly changing regulatory requirements
- Maintain investments in legacy systems

A fundamental constraint in meeting these goals

- 70% of healthcare is conducted in offices of fewer than 10 people*

* Shahid Shah, "Why Healthcare IT is in the State That It's In", http://www.ebizq.net/blogs/healthcare/2009/04/why_healthcare_it_is_in_the_state_that_its_in.php

Agenda

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Service Orientation

Service orientation has become a common approach for implementation of distributed, loosely-coupled systems

- Services provide reusable business functionality via well-defined interfaces.
- Service consumers are built using functionality from available services.
- There is a clear separation between service interface and service implementation.
  - Service interface is just as important as service implementation.
- An SOA infrastructure enables discovery, composition, and invocation of services.
- Protocols are predominantly, but not exclusively, message-based document exchanges.

Services

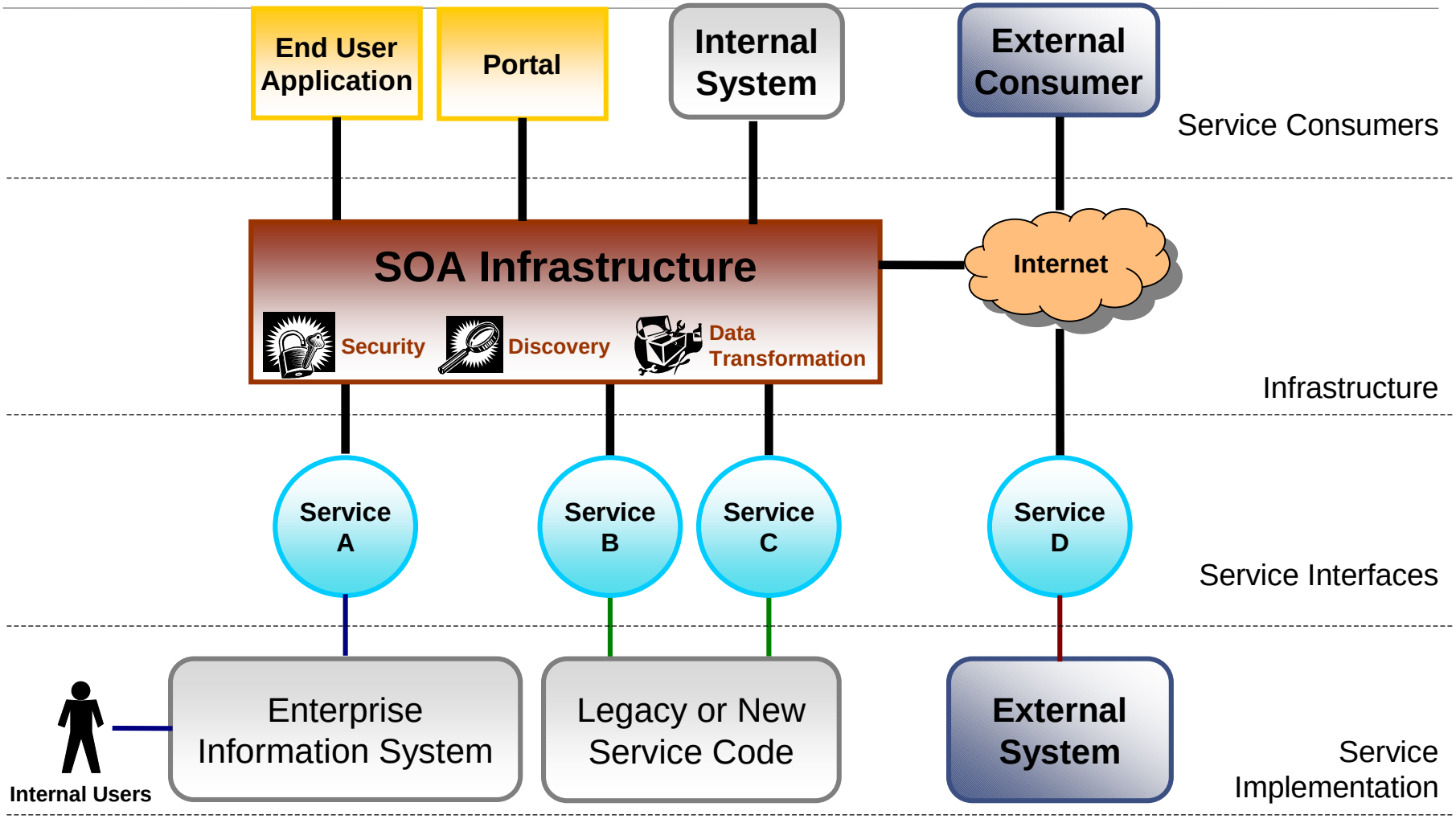
Services are reusable components that represent business tasks, e.g.

- Look up patient information
- Validate credit card
- Get test results
- Schedule appointment

Services can be

- Globally distributed across organizations
- Reconfigured into new business processes

Components of a Service-Oriented System



Benefits Associated with Service Orientation

Cost-Efficiency

- Services provide functionality that can be reused many times by many consumers
- Services become a single point of maintenance and management for common functionality

Agility

- Via service discovery mechanisms, developers can find and take advantage of existing services to reduce development times

Legacy Leverage

- Separation of service interface from service implementation provides true platform independence

Adaptability

- Separation of service interface from service implementation allows for incremental deployment of services and incremental modernization

Agenda

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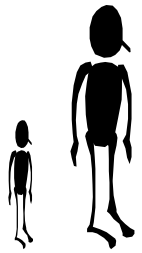
Legacy System Reuse Challenges

Reuse at the service level is more complex than reuse at the module or component level.

- From the service provider perspective
  - Designing reusable services requires a different approach, skill set, and mindset
  - Bigger stakeholder community because services are typically reused at organization and sub-organization level
  - Services need to be as generic as possible so that they are of interest to multiple service consumers and at the same time need to add value to potential consumers
- From the service consumer perspective
  - Larger granularity may lead to larger incompatibilities

Challenges can come from the legacy system from itself or from the environment.



Legacy System Challenges

It may not always be possible to reuse functionality of legacy systems by exposing them as services.

- Technical constraints due to the nature of the legacy system
  - A batch system needs to be exposed as a service for an interactive online Web application.
- Immature technology or lack of technology for a particular legacy environment

Cost of exposing a legacy system as services may be higher than replacing it with a new service-oriented system.

Agenda

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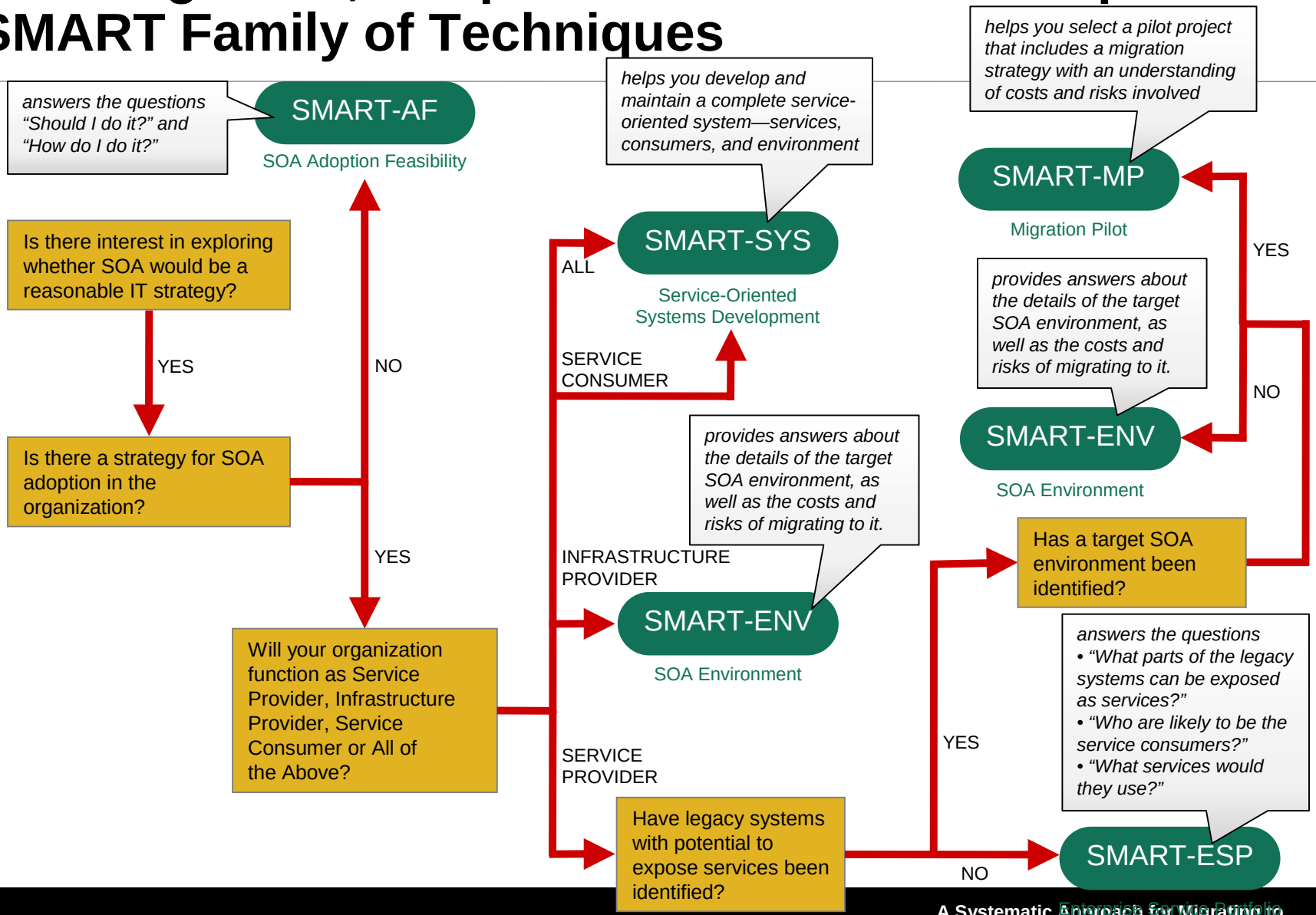
SOA Migration, Adoption and Reuse Technique: SMART Family of Techniques



Dilemmas for SOA Adoption

A set of dilemmas is often faced in SOA adoption:

- SOA seems to be a valid option but the organization is not completely convinced.
- SOA adoption has been mandated and the organization does not know where to start.
- An organization needs to fit into an existing SOA environment but it is not sure how.
- An organization wants to provide services in an SOA environment but it does not know what services it should provide to service consumers.
- An organization wants to expose functionality from selected legacy systems in an SOA environment but does not understand the implications of this migration.
- An organization wants to fully migrate a set of systems to an SOA environment and is looking for an understanding of the proper path for migration.

The SMART Family provides a set of techniques that helps organizations make better decisions on their path to SOA adoption

Three Elements of SMART: Tailored for Each Family Member)

Process 	SMART Interview Guide (SMIG) 	Artifacts 
Gathers information about • Goals and expectations of migration effort • Candidate services • Legacy systems • Target SOA environment Analyzes gap between legacy and target state	Guides discussions in initial SMART activities	• Stakeholder List • Characteristics List • Migration Issues List • Business Process-Service Mapping • Service Table • Component Table • Notional Service-Oriented System Architecture • Service-Component Alternatives • Migration Strategy

SMIG Examples

Discussion Topic	Related Questions	Potential Migration Issues
Goal and Expectations of Migration Effort	• What are the business and technical drivers for the migration effort? • What are the short-term and long-term goals?	• No SOA strategy • Goals for migration are not clear.
High-Level Understanding of Legacy System	• What is the main functionality provided by the legacy system? • What is the high-level architecture of the system? • What is the current user interface to the system?	• Legacy system knowledge is not available. • Architectural mismatch • User interface complexity hard to replicate in service consumers
High-Level Understanding of Target SOA Environment	• What are the main components in the target SOA environment? • Is this the organization's first attempt to deploy services in this environment?	• Target SOA environment has not been identified. • No in-house knowledge of target SOA environment
Potential Service Consumers	• Who are the potential service consumers?	• Consumers for services have not been identified.

Agenda

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SMART-AF: Basic Approach

Understand the business and technical context for adopting SOA

- Rationale, goals and expectations
- Technical and business drivers
- Programmatic constraints (e.g. schedule, budget)

Identify stakeholders

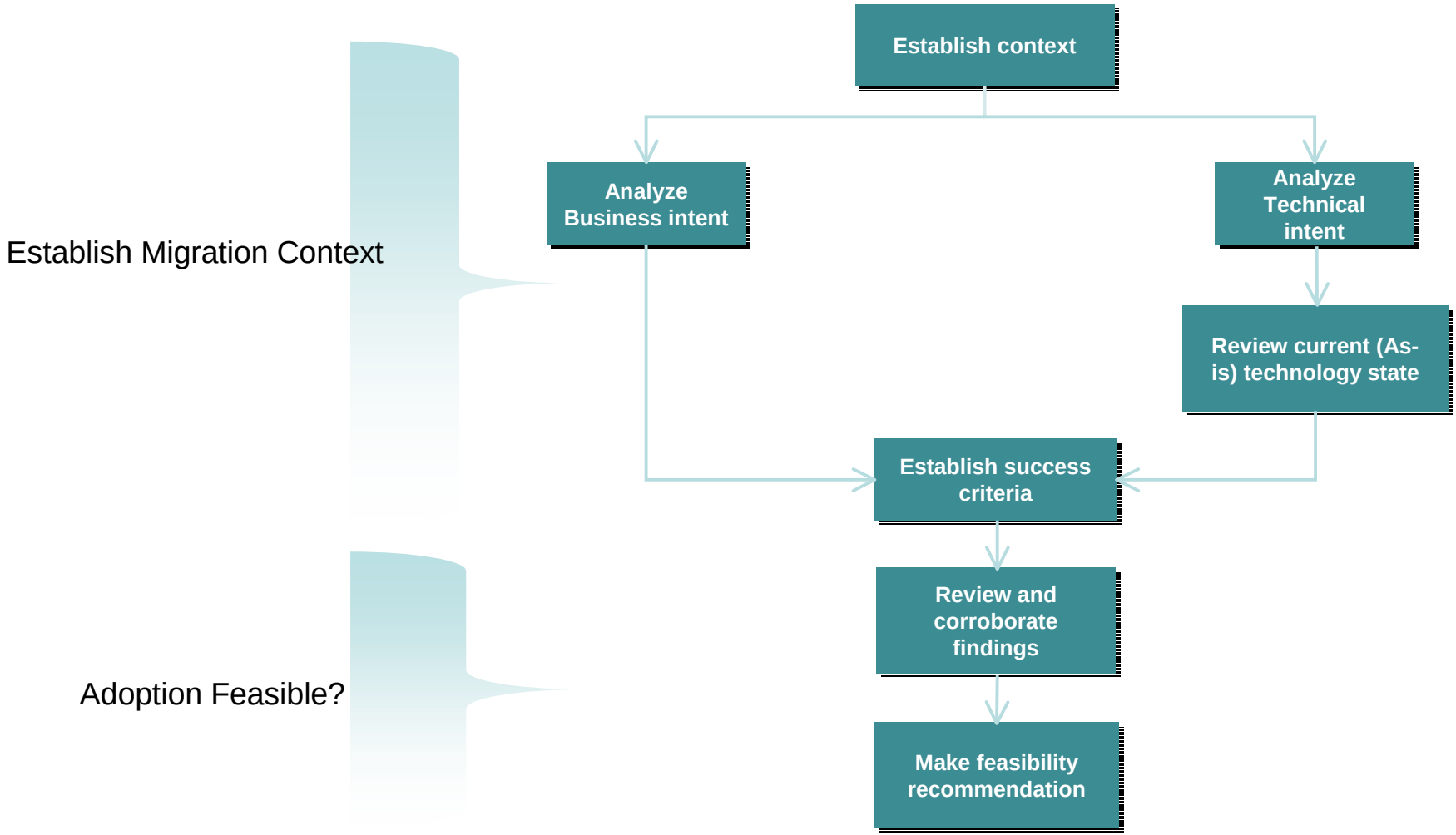
- Who is driving and paying for the effort
- Who knows what about the software asset base, the expected changes to business processes, and the financial aspect of the migration
- Demand or need for SOA within the organization

Identify a set of potential benefits, risks, value factors, and specific steps that would be necessary

Potential outcomes

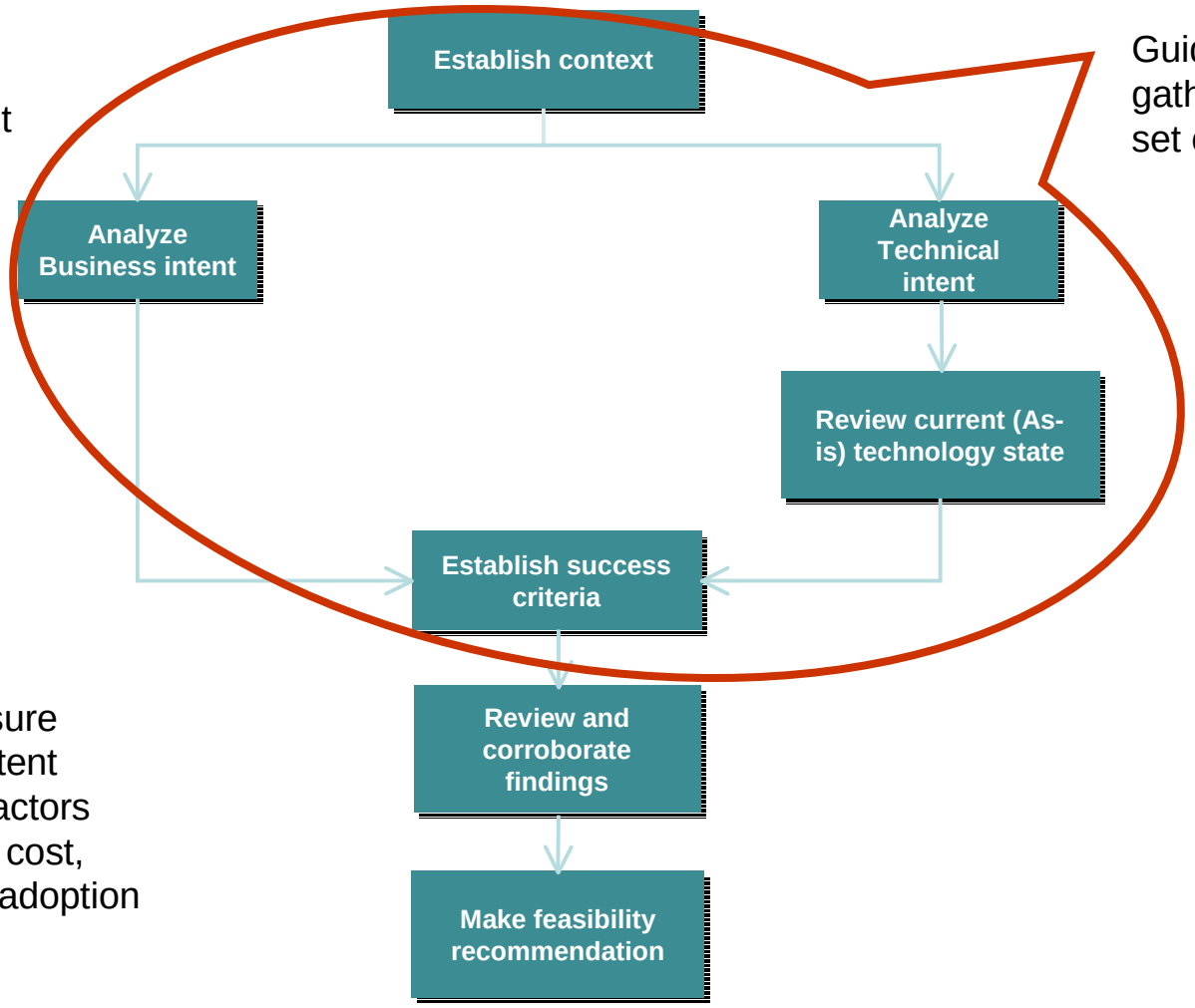
- The adoption is essentially feasible
- The adoption has potential but requires additional information to make an informed decision
- The adoption is not feasible

SMART-AF Process Activities



SMART Interview Guide - AF (SMIG-AF)

Questions that gather information about the adoption context, the technical and business goals, and the state of the legacy IT asset base



Guides information gathering for the first set of activities

The goal is to assure broad and consistent coverage of the factors that influence the cost, effort, and risk in adoption to services.

Agenda

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SMART-ESP: Basic Approach

Identify candidate enterprise services

- Identify key business goals
- Identify existing and desired business processes that support those goals
- Identify the process steps in the business processes
- Identify existing process steps that match common future process steps
- Identify the systems that are involved in these common steps

Populate the enterprise service table by examining and classifying the capabilities that can be harnessed and exposed as services.

- The enterprise service table is a representation of the desired services that will be offered to service consumers in the enterprises service-oriented architecture

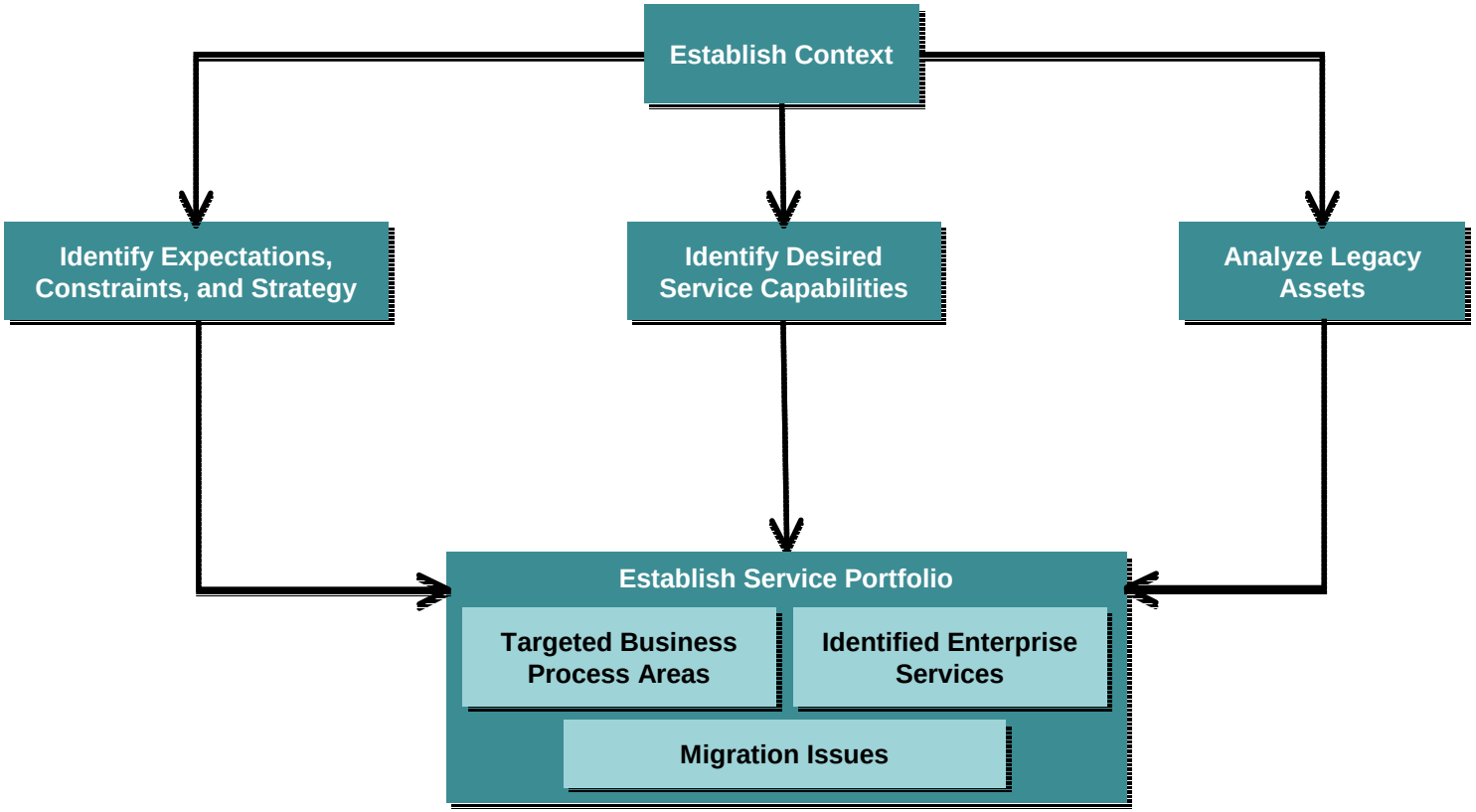
Develop a strategy for implementing the candidate services

- Consider sourcing options if no existing process steps match common future process steps
- Sourcing options may include buy versus build, quality of service contracts, service contracts, functionality, etc.

Maintain a Business Process -Service Mapping Table

- The business process - service mapping table maintains a record of the desired services and the business processes employing them.

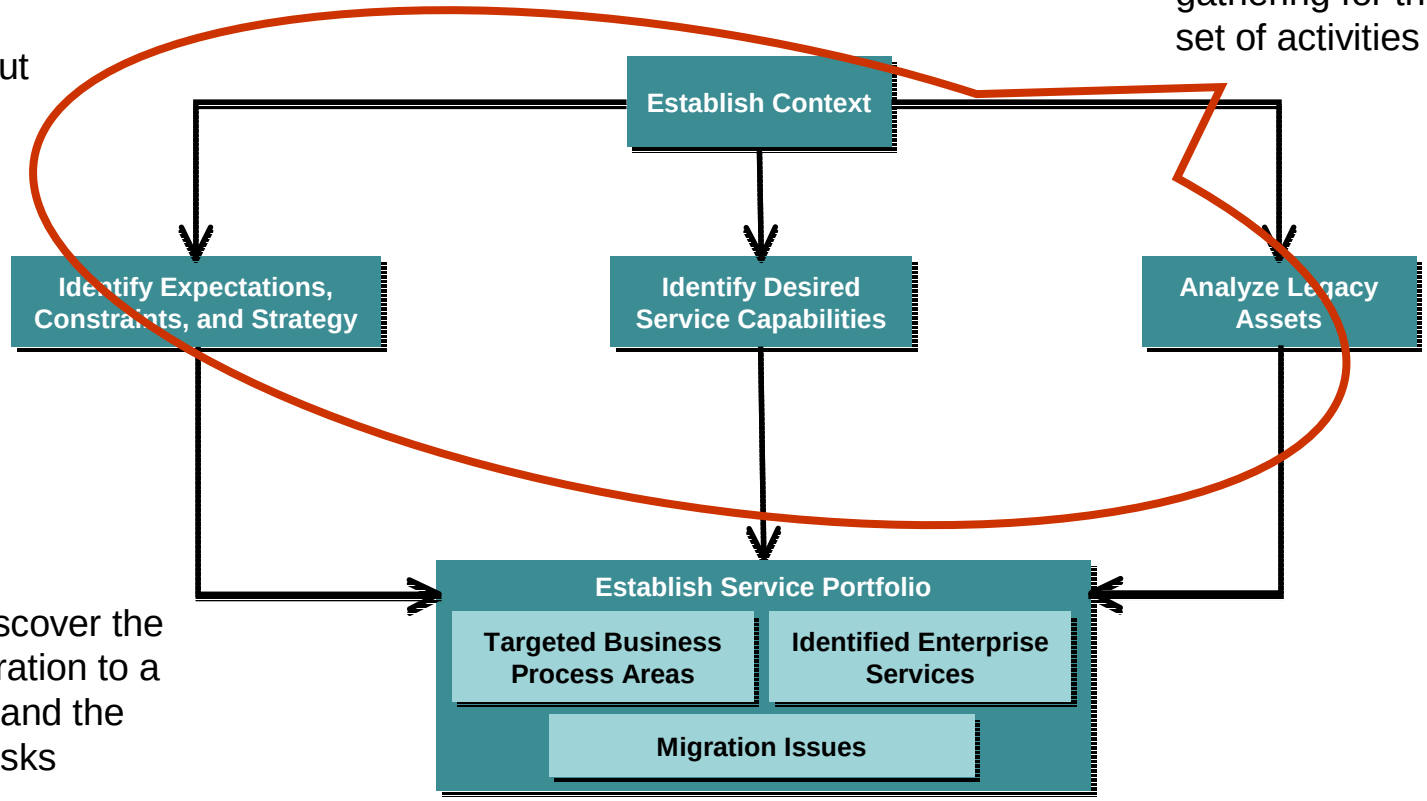
SMART-ESP Process Activities



SMART Interview Guide - ESP (SMIG-ESP)

15 categories of questions that gather information about the adoption context, the technical and business goals, and the state of the legacy IT asset base

Guides information gathering for the first set of activities



The goal is to discover the feasibility of migration to a service portfolio and the accompanying risks

Agenda

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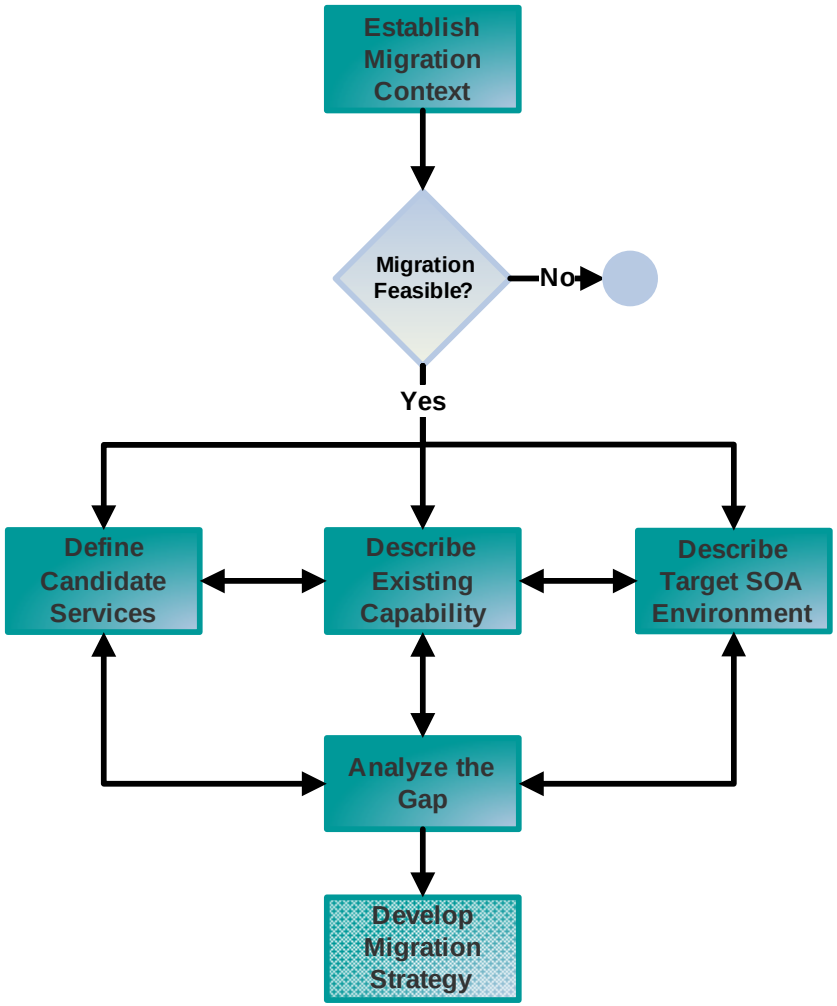
SMART: MP (Migration Pilot)

SMART identifies a pilot project that will help shape a migration strategy for an organization, along with an understanding of cost and risk involved.

SMART analyzes the viability of reusing legacy systems in an SOA environment:

- Does it make sense to migrate the legacy system to services?
- What services make sense to develop?
- What legacy system components can be used to implement these services?
- What changes to components are needed to accomplish the migration?
- What migration strategies are most appropriate?
- What are the preliminary estimates of cost and risk?
- What is an ideal pilot project that can help address some of these risks?

SMART MP Process Activities



Describe Existing Capability: SMIG Examples

Discussion Topic	Related Questions	Potential Migration Issues
Legacy System Characteristics	• What is the history of the system? • Is the system a proof of concept, prototype, under development, in testing, or a fielded system? • What system documentation is available? • Does the system have interfaces to other systems? • What are potential locking, persistence, or transaction problems if accessed by multiple users when migrated to services?	• Planned development concurrent with service migration • Limited system documentation • Interfaces to other systems will open doors to service consumers. • Single-user system may have problems in a multi-user environment.
Legacy System Architecture	• What architecture views are available? • What are the major modules of the system and dependencies between modules? • Is user interface code separate from the business logic code? • Are there any design paradigms or patterns implemented in the system? • What are the key quality attributes built into the current architecture of the system?	• Lack of architecture documentation may lead to underestimation of complexity. • Tight coupling between user interface code and business logic code increases effort. • Undocumented violations of design patterns may cause problems. • Key quality attributes may not hold true in a services environment.
Code Characteristics	• What code documentation is available? • What coding standards are followed?	• Poor coding practices will increase migration effort.

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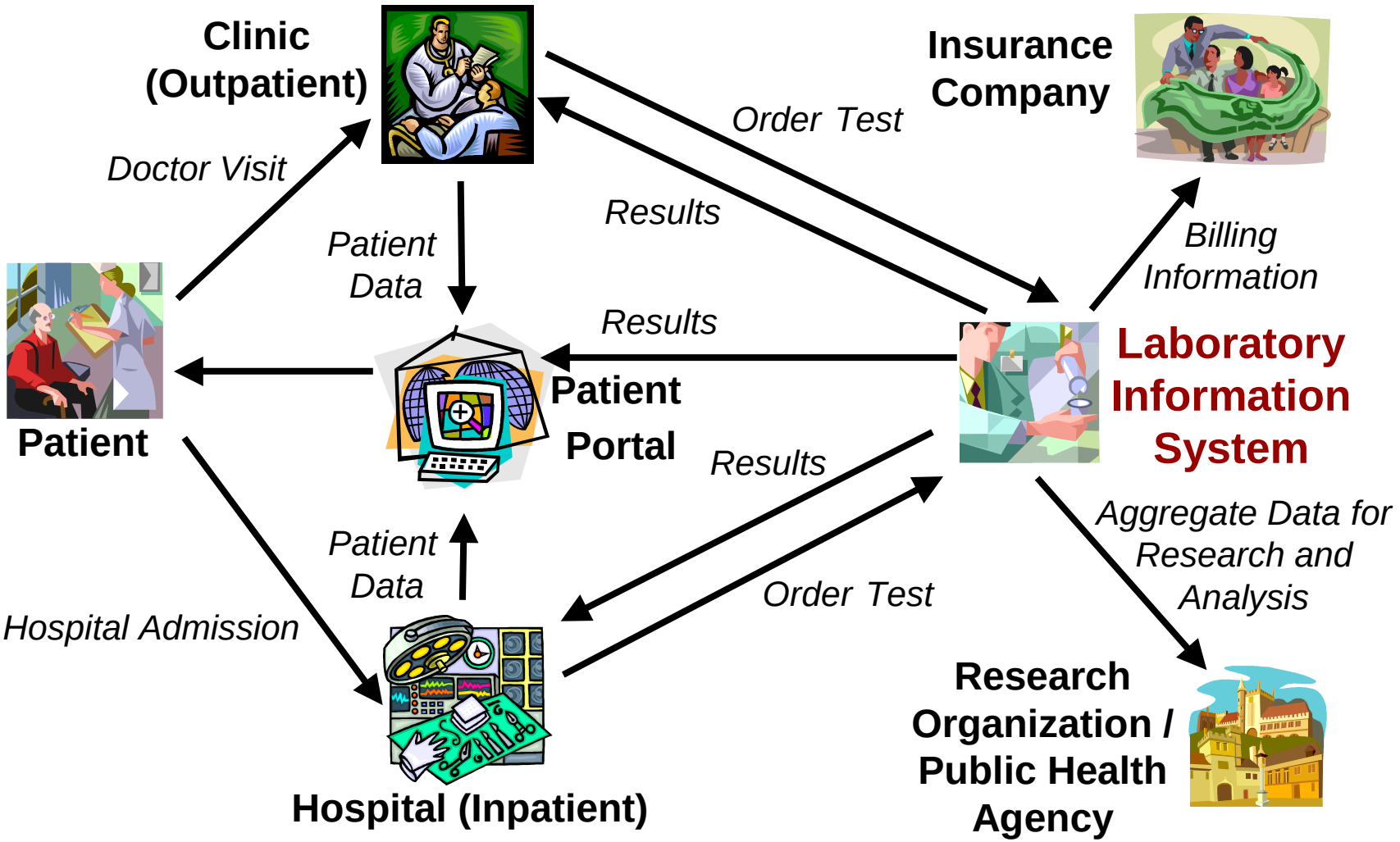
Example: Laboratory Information System (LIS)



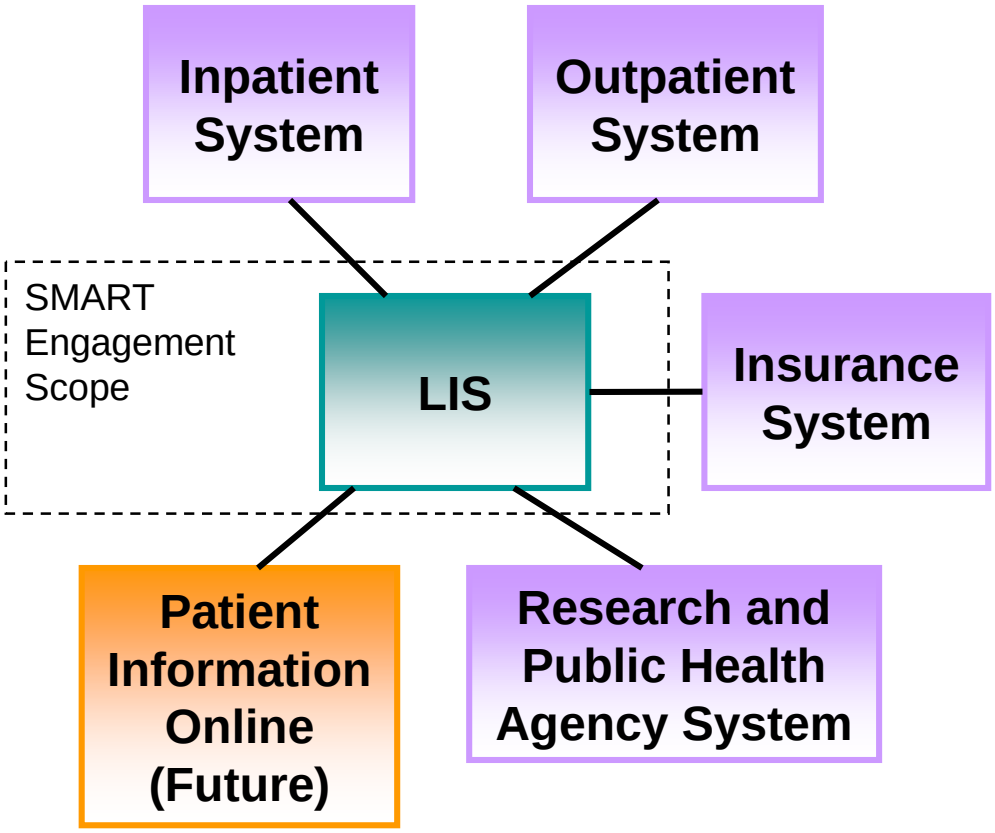
Context: LIS Context Diagram

Lab information shared between many systems

Need to move to a SOA environment to increase reusability of common lab tasks

Key questions:

1. Which services should be created?
2. In what order?
3. Should some legacy components be replaced with new components?



LIS: Drivers for Legacy Migration

Improve patient care by

- Providing access to lab information from any clinical system in real time (current access is mostly batch-oriented)
- Making lab information accessible to patients via the Internet using a patient portal

Reduce IT costs by

- Creating common and reusable services
- Reducing the number of different interaction points (interfaces)
- Lowering maintenance and upgrade costs

LIS: Legacy System at a High Level

Laboratory Information System (LIS)

- 800,000 lines of code
- Six major modules—~2500 C++ classes and ~1500 Java classes
  - Lab Test Catalog module is written in Java but is actually a wrapper to a legacy COBOL system
- Some components run on Windows operating system and some on Linux OS

Interaction with external systems is point-to-point through dedicated sockets

- Some data transfers are done in batch mode overnight (i.e., lab results)
- Not all exchanged information uses the same version of HL7 (V3 vs. V2.X)

Dependencies on several commercial products

- Oracle Database
- Weblogic Application Server

LIS: Target SOA Environment at a High Level

Evaluating several Enterprise Service Bus (ESB) products for support of Web Services

- An ESB is a middleware product that connects and mediates all communications and interactions between service consumers and services, usually based on standards
- Typical ESB functionality includes
  - Invocation
  - Routing
  - Mediation
  - Process Orchestration
  - Complex Event Processing
  - QoS
  - Management

LIS: Target SOA Environment Constraints

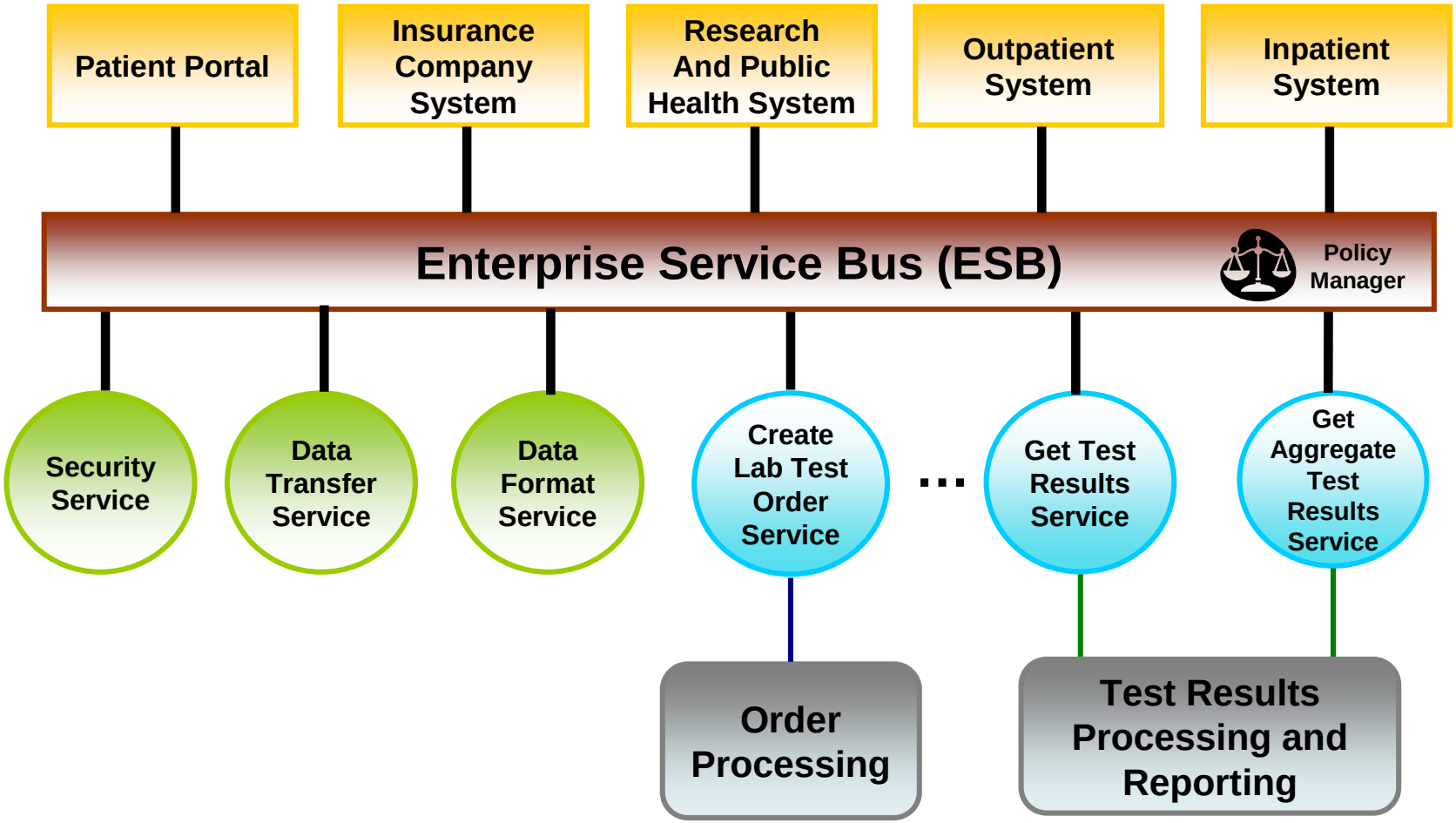
Services need to support different versions of the HL7 standard.

- Patient Portal will use the XML-complaint v3 version of HL7.
- EMR systems (Outpatient, Inpatient) plan to move to HL7 v3 in near term while others do not have any plans.

Services need to take into account the different policy requirements for the same data.

- Research data should be completely anonymous (without any Personally Identifiable Information – PII).
- Inpatient/outpatient data should be completely identifiable for each patient.

LIS: Notional Service-Oriented System Architecture



LIS: Service-Component Alternatives

Service	Options	Components	Effort (Person-Weeks)	Cost	Level of Difficulty	Level of Risk
Get Test Catalog	Create interface to LabTestCatalog component	LabTestCatalog	3	$ 9,375	Low	Low
	Rewrite code wrapped by LabTestCatalog component in Java		15	$ 46,875	High	Medium
Get Test Results	Create interface to ResultsProcessor components	…	…	…	…	…
…						

LIS Migration Strategy 1

Perform workshop with key stakeholders.

Select ESB product based on available budget, service requirements, and preliminary evaluations, aware that this many not be the final selection.

Implement *Get Test Catalog* service as a pilot.

Validate privacy and security requirements against infrastructure security service.

Understand implications of policy management component provided by SOA infrastructure.

Evaluate SOA infrastructure against evaluation results and refined service requirements based on lessons learned in pilot.

Implement final SOA infrastructure.

LIS Migration Strategy 2

Document implementation guidelines for service developers.

Adjust estimates and create a plan for the migration of the remaining candidate services.

Implement migration plan.

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Summary 1

Reuse at the service level is more complex than reuse at module or component level.

- Designing reusable services requires a different approach, skill set, and mindset
- Bigger stakeholder community because services are typically reused at organization and sub-organization level

Cost of exposing legacy system functionality as services may be higher than actually replacing the system with a new service-oriented system.

- Detailed analyses are needed

Summary 2

Legacy system reuse in SOA environments requires

- Identification of requirements of the target SOA infrastructure
- Clear distinction between the needs that can be satisfied by the legacy system and those that cannot be satisfied
- Systematic analysis of changes that need to be made to work with target SOA infrastructure

SMART analyzes the viability of migrating from legacy systems in SOA environments.

References

SMART: The Service Migration and Reuse Technique

- SMART: Analyzing the Reuse Potential of Legacy Components in a Service-Oriented Architecture Environment: http://www.sei.cmu.edu/publications/documents/08.reports/08tn008.html

T-Checks

- Process: http://www.sei.cmu.edu/publications/documents/05.reports/05tn025.html
- Applications:
  - Business Process Management in a Web Services Context: http://www.sei.cmu.edu/publications/documents/08.reports/08tn005.html
  - Web Services and Security: Single Sign-On: http://www.sei.cmu.edu/publications/documents/08.reports/08tn026.html
  - Open Grid Services Architecture: http://www.sei.cmu.edu/publications/documents/07.reports/07tn016.html
  - Web Services: http://www.sei.cmu.edu/publications/documents/06.reports/06tn021.html
  - OWL-S (OWL Web Ontology Language for Services): http://www.sei.cmu.edu/publications/documents/06.reports/06tn018.html
  - MDA (Model-Driven Architecture): http://www.sei.cmu.edu/publications/documents/05.reports/05tn022.html

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