SOA for Healthcare: Promises and Pitfalls

Dennis B. Smith
dbs@sei.cmu.edu

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Agenda

Healthcare IT Challenges ⇦

SOA: The Promises

SOA: The Pitfalls

SOA: The Path Forward

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

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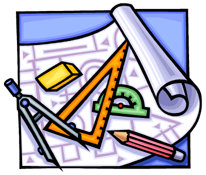
What is SOA?

Service-oriented architecture (SOA) is a way of designing, developing, deploying and managing systems, in which

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



Services

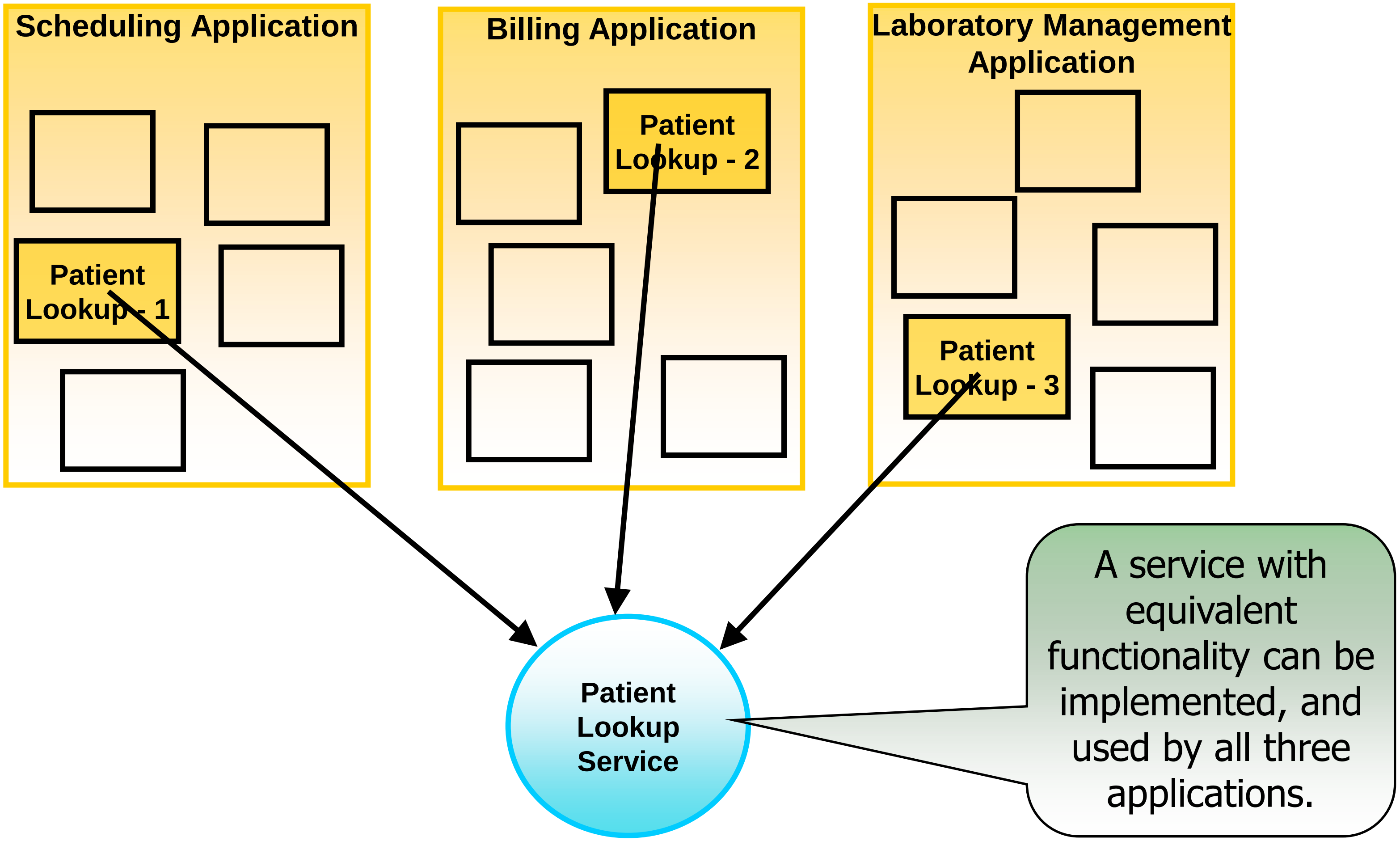
Services are reusable components that represent business tasks, e.g.

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

Services can be

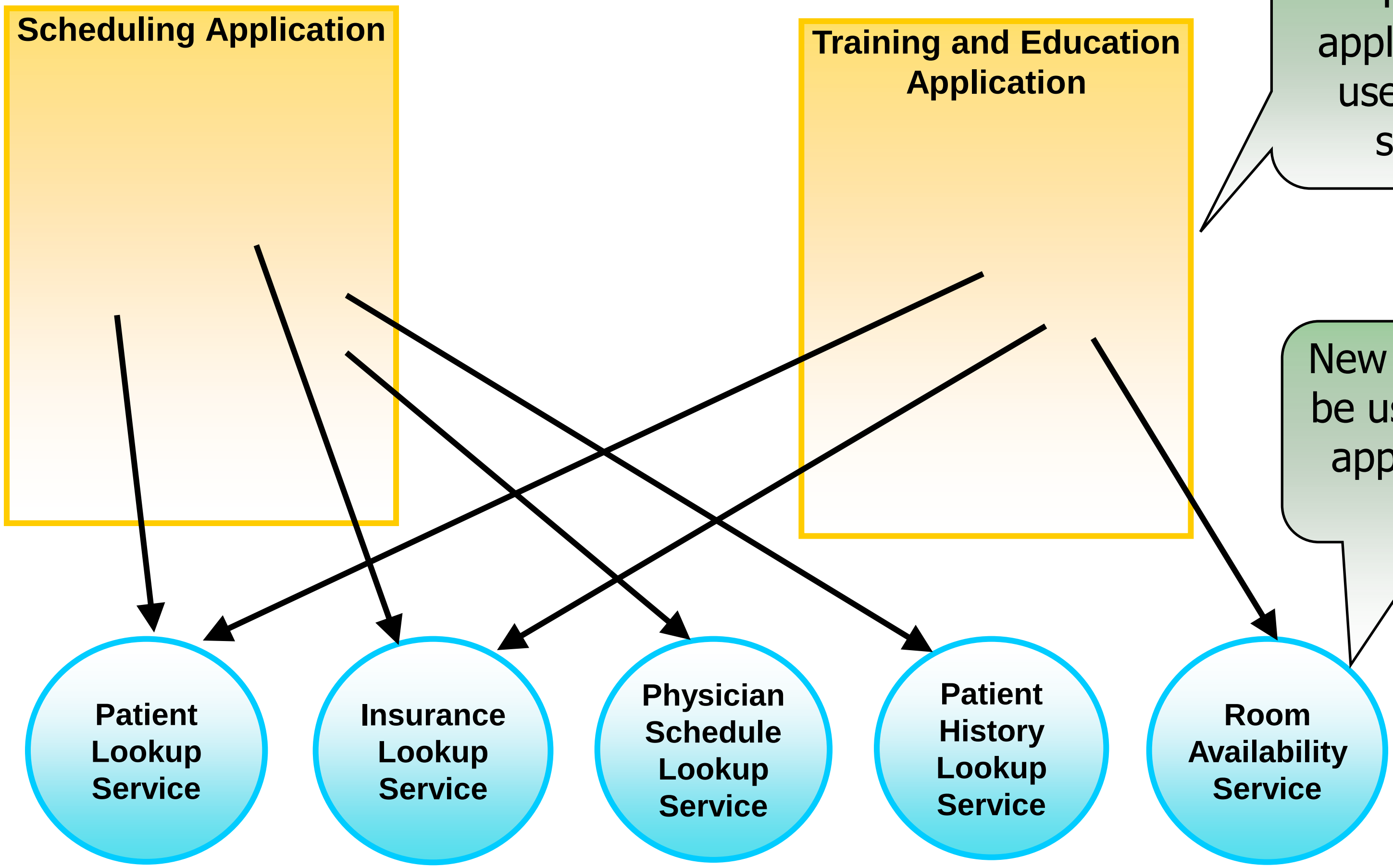
- Globally distributed across organizations
- Reconfigured into new business processes

Promise 1: Cost-Efficiency



A service with equivalent functionality can be implemented, and used by all three applications.

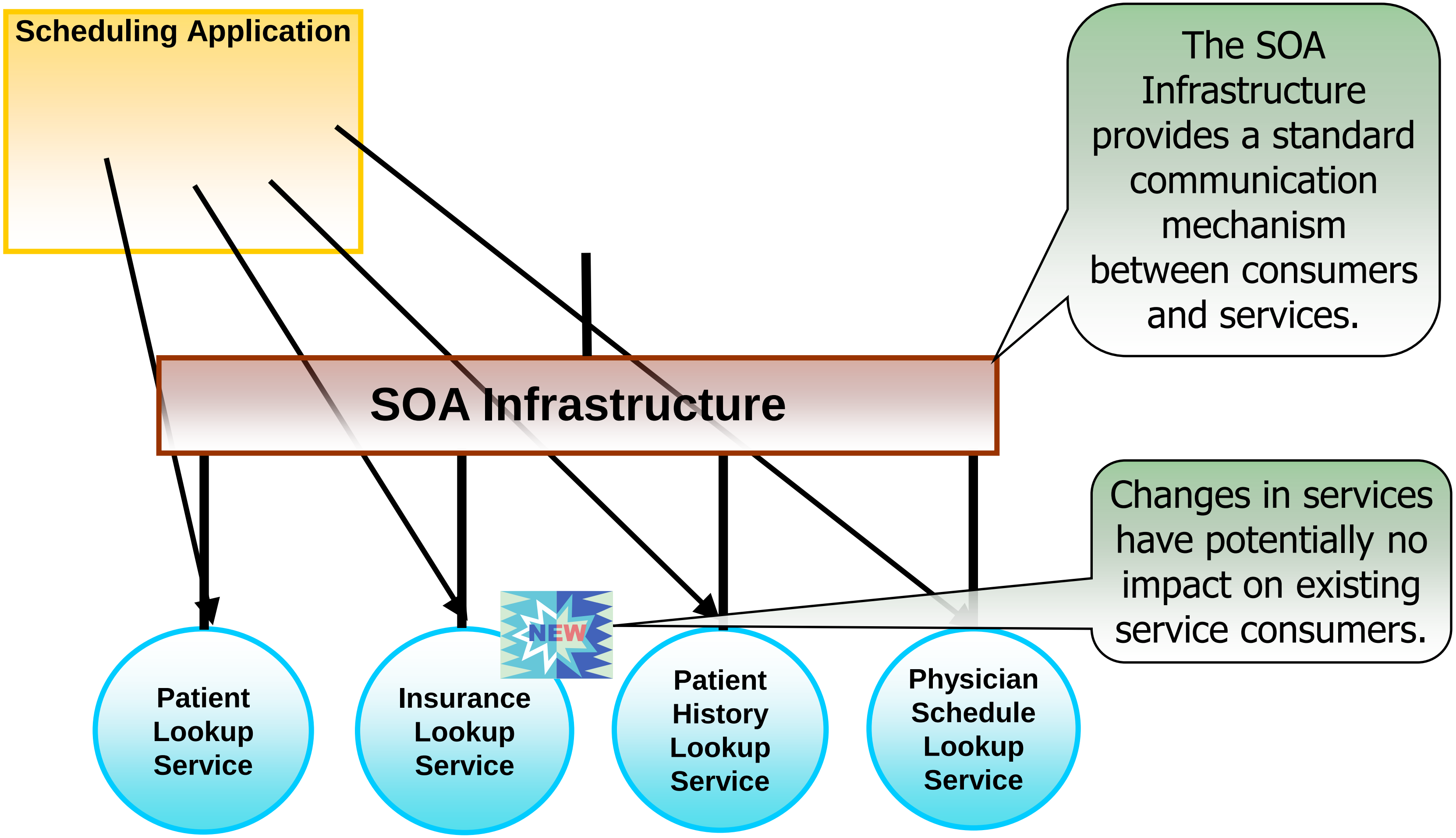
Promise 2: Agility


Scheduling Application
Training and Education Application
Patient Lookup Service
Insurance Lookup Service
Physician Schedule Lookup Service
Patient History Lookup Service
Room Availability Service

The new application can use available services.

New services can be used by other applications as well.

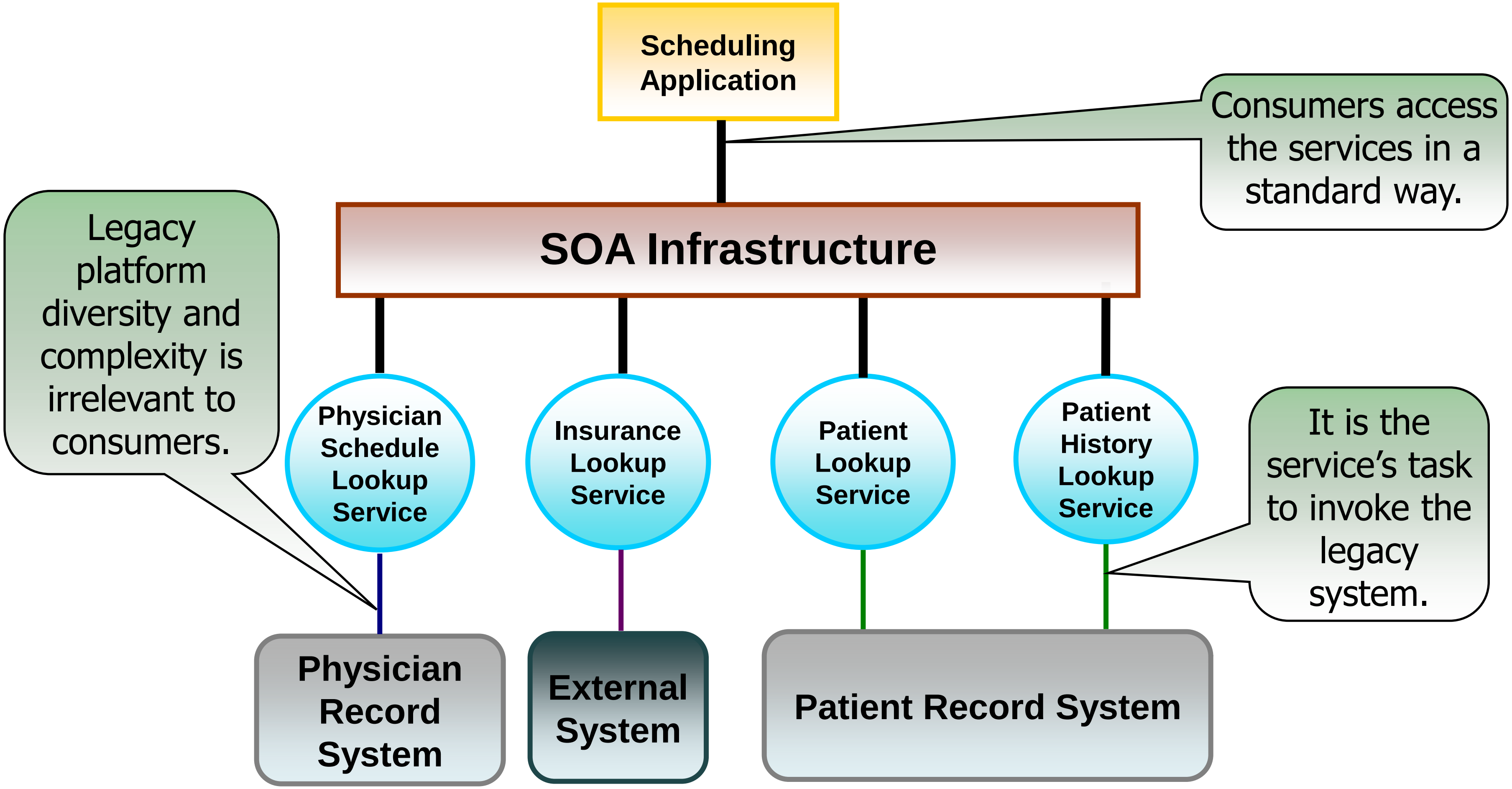
Promise 3: Adaptability



The SOA Infrastructure provides a standard communication mechanism between consumers and services.

Changes in services have potentially no impact on existing service consumers.

Promise 4: Legacy Leverage

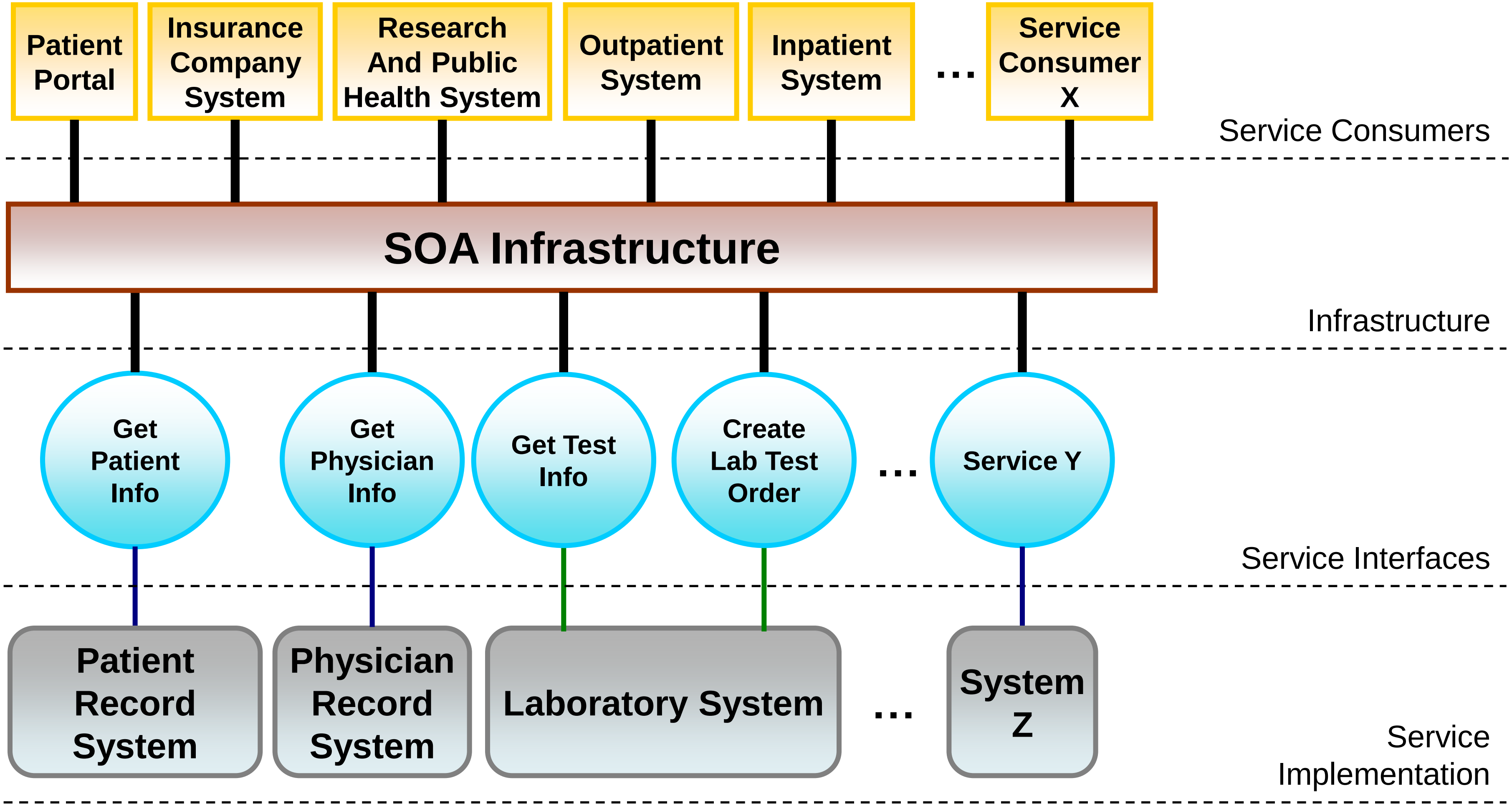


Consumers access the services in a standard way.

Legacy platform diversity and complexity is irrelevant to consumers.

It is the service's task to invoke the legacy system.

A Notional Service-Oriented System Architecture



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SOA is Real

Many successful case studies, mainly in commercial enterprises

Main goal for adoption of SOA is internal integration and business process improvement

Main adoption barriers are lack of governance and finding people with the right skills

Currently the best option available for loosely coupled systems integration and leverage of legacy systems

The technologies to implement SOA will change over time, but the concepts are here to stay

- SOA is much broader than its most popular instantiation (Web Services)

However …

SOA is potentially being stretched beyond is limits

- What was initially an approach for asynchronous document-based message exchanges now has performance, availability, reliability, security and other expectations of traditional distributed systems

The required link between business goals and SOA value is not clear for SOA adopters—still seen as simply a new technology

- Lack of education
- Lack of people with both technical and business skills
- Large amount of vendors in the SOA market—each with their own discourse—does not help

SOA Does Not Provide the Complete Architecture for a System

SOA is an architectural pattern/style/paradigm and not the architecture of the system itself.

An architectural pattern provides guidance that embodies best practices.

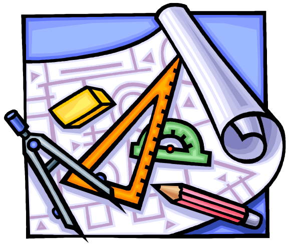
- The concrete elements and their interactions are the architecture of the system.

Any number of systems can be developed based on an architectural pattern.

- An architecture based on SOA inherits both the good and the bad.

Corollary: SOA cannot be bought off-the shelf.

- System qualities have to be built into the architecture of the system.
- Decisions have to be made—service design and implementation, technologies, tradeoffs.



All Legacy Systems Cannot Be Automatically Integrated into a SOA Environment

Upfront hands-on analysis on the technical feasibility and cost-benefit must be performed on a per-system basis.

- Is it technically feasible to create a service from the legacy system or part of the system?
- How much would it cost to expose the legacy system as services?
- Is this cost plus the cost of maintaining the legacy system more than the cost of replacing it with a new one?
- What changes will have to be made to the legacy system?
- How much will these changes affect current users and other production systems?

It might just not make sense to migrate the legacy system to an SOA environment.

The Use of Standards Does Not Guarantee Interoperability

Interoperability needs agreement on both syntax and semantics.

Web Services enable syntactic interoperability.

- XML Schema defines structure and data types.
- WSDL defines the interfaces: operations, parameters and return values.
- Available information, technologies, and tool support.

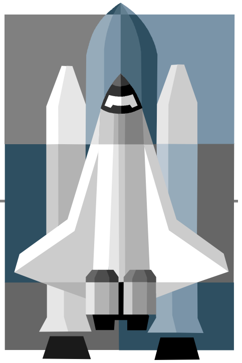
Web Services do not guarantee semantic interoperability.

- XML and WSDL do not define the meaning of data.
- WSDL does not define what a service does.
- It is an active research area—unresolved issues.

With Healthcare, the HL7 v3 messaging standard defines electronic interface messages to support healthcare workflows

- This provides a starting point for getting away from unique interfaces

SOA Is Not All About Technology



SOA not only means a shift in technology but also changes in the organizational governance model.

What life-cycle model should be followed for services?

- Service requirements and definition
- Service development, composition, and testing
- Service evolution and change management

What other governance mechanisms are required?

- Conflict resolution
- Deployment mechanisms
- Monitoring mechanisms
- Enterprise-wide policies
- Service-level agreements
- Service registries

Developing Applications Based on Services Remains Complex

It is relatively easy to build applications and services that work with a particular infrastructure . . . but designing a “good” service might not be that easy.

From a service provider perspective

- Not many best practices for designing services
  - What is the right granularity?
  - What is the right Quality of Service (QoS)? Can you guarantee it?
- Have to know and anticipate potential consumers and usage patterns
  - “If you build it they will come” – Can you afford this?

From a service consumer perspective

- Ease depends on tool availability for SOA infrastructure.
- Larger granularity may lead to larger incompatibilities.
- Most difficult part is composition—data and process mismatches.

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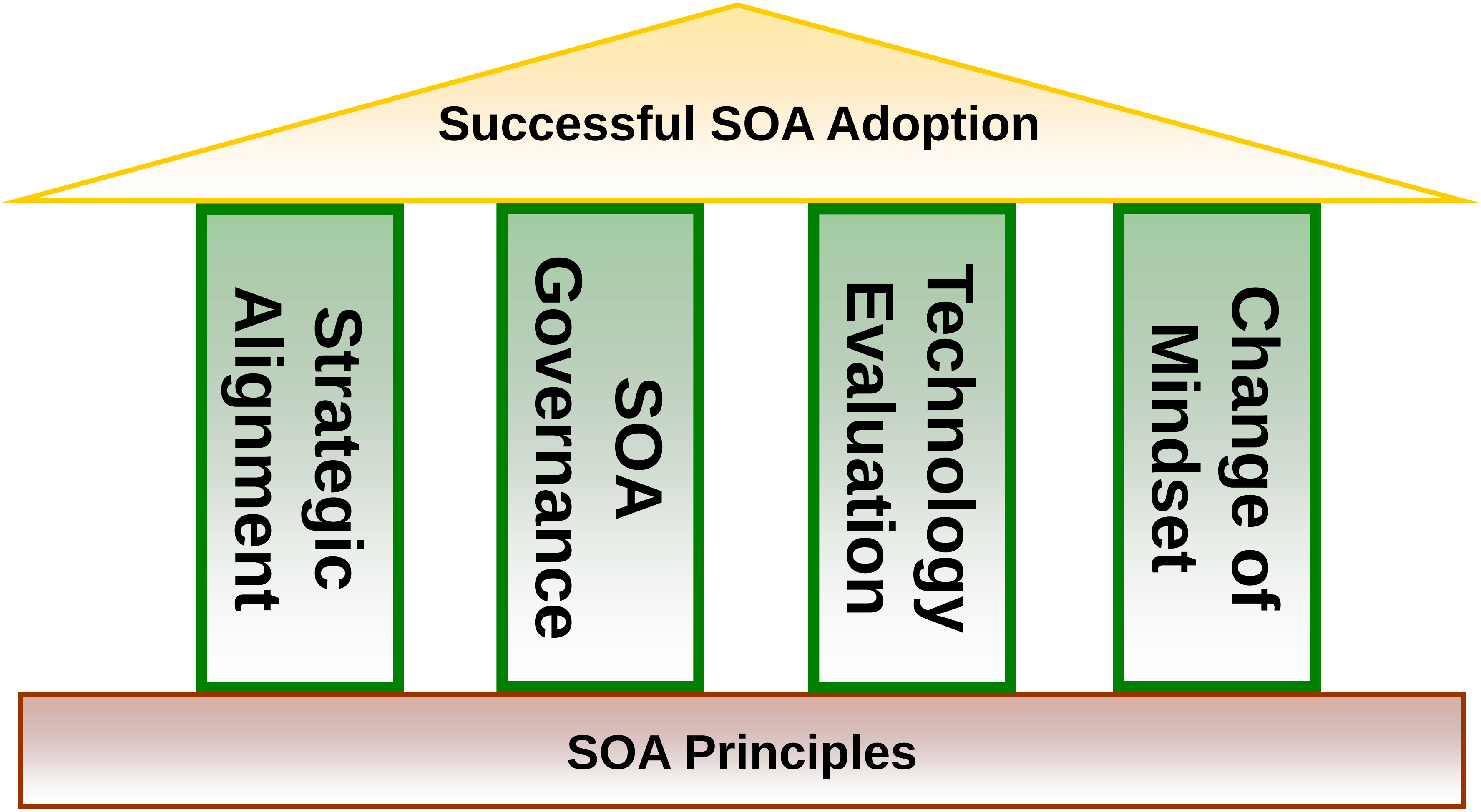
The Path Forward: Pillars of SOA Adoption



Successful SOA Adoption

Strategic Alignment

SOA Governance

Technology Evaluation

Change of Mindset

SOA Principles

Alignment with Business Goals

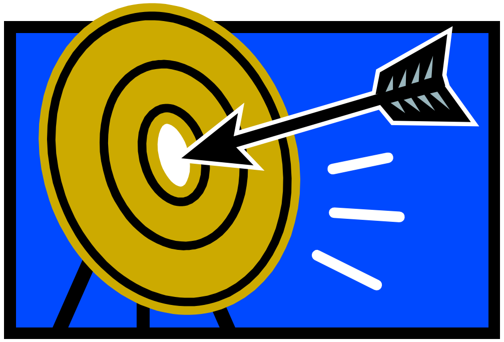
Strategic Alignment

Any successful SOA strategy has to be aligned with business goals.

The first question any organization should ask itself is: “Why am I adopting SOA?”

Examples

- Reduce time-to-market for applications
- Increase information available to patients
- Integrate healthcare partners
- Decrease development cost by increasing reuse
- Reduce maintenance costs
- Improve patient
- Improve internal processes



Different Business Needs and Goals Drive Different SOA Strategies

Strategic Alignment

Business Needs and Goals	SOA Strategy
Increase information available to patients	• Intuitive portals • Creation of services related to patient information
Integrate healthcare partners	• Heterogeneous interoperability • Back office integration • Identification of business rules
Improve business processes	• Identification of key processes • Elimination of redundancy • Consistency between processes • Services that access legacy systems

SOA Governance

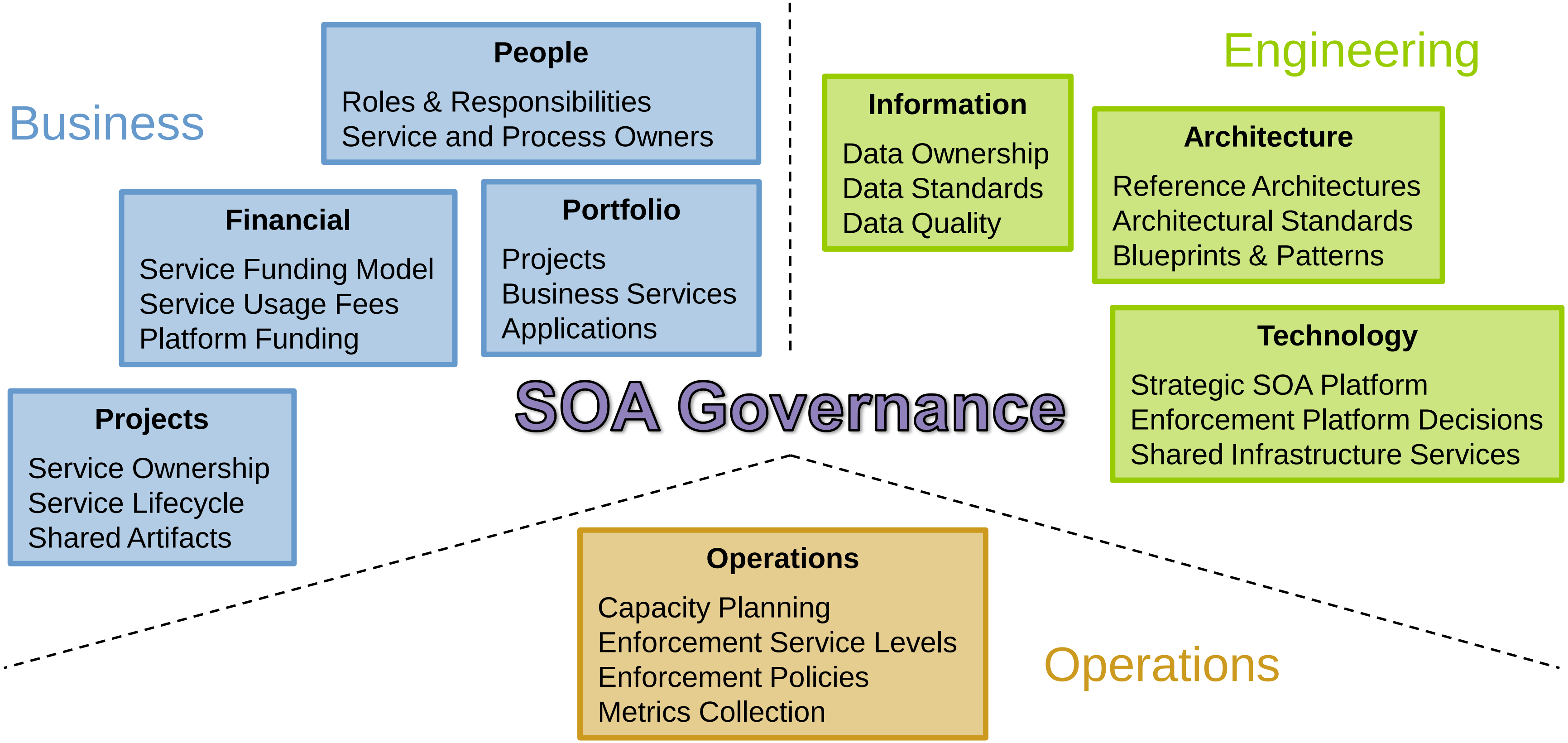
SOA governance provides a set of policies, rules, and enforcement mechanisms for developing, using, and evolving SOA assets and for analysis of their business value.

It provides the **who**, that **what** and the **how** business, engineering and operations decisions are made in order to support a SOA strategy.

- Policies and procedures
- Roles and responsibilities
- Design-time governance
- Runtime governance

Source: Integration and SOA: Concepts, Technologies and Best Practices. Beth Gold-Bernstein & Gary So.

Examples of Governance Elements



SOA Governance

Business

People
Roles & Responsibilities
Service and Process Owners

Financial
Service Funding Model
Service Usage Fees
Platform Funding

Portfolio
Projects
Business Services
Applications

Projects
Service Ownership
Service Lifecycle
Shared Artifacts

Engineering

Information
Data Ownership
Data Standards
Data Quality

Architecture
Reference Architectures
Architectural Standards
Blueprints & Patterns

Technology
Strategic SOA Platform
Enforcement Platform Decisions
Shared Infrastructure Services

Operations

Operations
Capacity Planning
Enforcement Service Levels
Enforcement Policies
Metrics Collection

Source: Governance elements adapted from Oracle's SOA Governance Model

Match of Technologies to the Problem Domain

Technology Evaluation

Need a realistic understanding on what technologies can do in the specific problem domain

How to understand and keep up with the “alphabet soup”?

- XML, SOAP, WSDL, UDDI, HL7, WS-Security?

How to determine which standards and technologies to implement in specific situations?

How to build systems that are resilient to changes in standards and commercial products that implement them?

How to determine if selected technologies will meet QoS requirements?

- Security
- Availability
- Performance

All the above questions suggest a need for **contextual experimentation**

Service-Oriented Systems Require a Different Development Approach

Change of Mindset

Traditional Systems Development	Service-Oriented Systems Development
Tight coupling between system components	Loose coupling between service consumers and services
Semantics shared explicitly at design time	Semantics shared without much communication between developers of consumers and services —In the future, even at runtime
Known set of users and usage patterns	Potentially unknown set of users and usage patterns
System components owned by the same organization	Systems components potentially owned by multiple organizations

Starting Point: Healthcare Community

Healthcare Services Specification Project (HSSP): The Practical Guide for SOA in Health Care*

- Identifies core SOA principles
- Develops a business case for SOA
- Provides guidance on steps for SOA implementation
  - Defining “as-is” state
  - Defining “to-be” state
  - Specifying architecture and services
  - Building transition and implementation plans
- A good starting point!

* Collaborative effort between Health Level seven (HL7) and Object Management Group (OMG)

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SOA is an approach to software development where

- Services provide reusable functionality with well-defined interfaces.
- An SOA infrastructure enables discovery, composition, and invocation of services.
- Service consumers are built using functionality from available services.

SOA can enable agility, legacy leverage , adaptability and cost efficiency for healthcare systems. However, success requires:

- Strong software engineering discipline
- A focused SOA strategy
- Effective governance processes
- Informed technology decisions
- Plans for addressing culture change