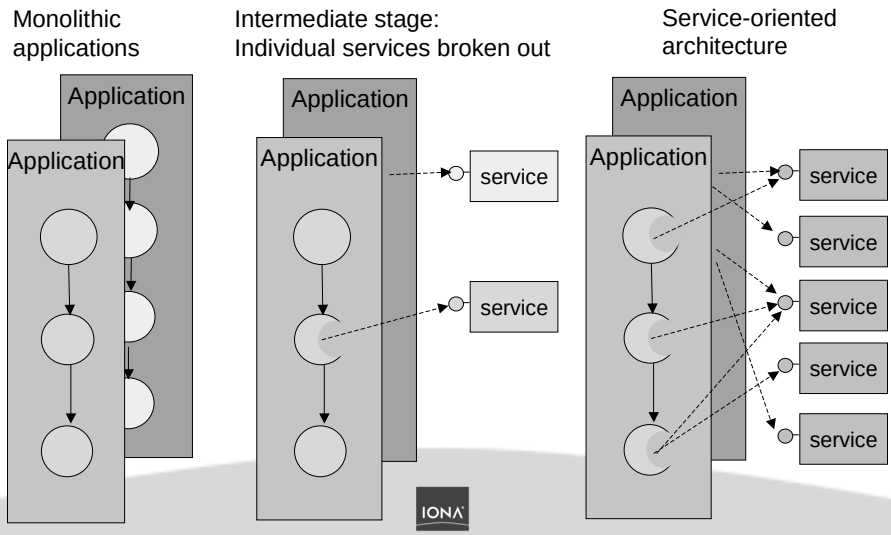
Overview of Service Oriented Architecture

- Incremental Adoption
- A guiding analogy
- Terminology excursion
  - Service, interface, architecture model, architecture style, service-oriented architecture
- Benefits of service-oriented design
- Examples of successful service-oriented design
- Summary

Incremental approach to an SOA



A guiding example

Bank Teller analogy for service-orientation

- Different types of tellers offer different services

  Tellers specialized to perform only certain types of transactions (which are typically closely related)

  Example partitioning:
  - Account Management (Opening and closing accounts)
  - Credits (inquiry about conditions, consulting, applying for mortgages)
  - Cash Register (Withdrawals, deposits, funds transfers)
  - Currency exchange (buy and sell foreign currencies)
- There may be several tellers offering the same set of services (for load balancing / failover)
- What happens behind the counter is not your business (bulletproof glass, iron bars)
- If you require a complex transaction, you may have to visit several tellers (customer as transaction coordinator)

Terms and Definitions

Service (Definition)

A ***service*** is a package of closely related standardized functions, which are called repeatedly in a similar fashion, and should therefore be implemented by a dedicated facility, which can be specialized to perform them.

Example: *Account Management*

A service can be partitioned and have multiple ***service functions***.

Example: *Open new account*

The smallest subunits within service functions are called ***service primitives (also sometimes called the service)***.

Example: *Generate next available account number*

Terms and Definitions

Characteristics to completely describe a service

Service requester ("client")

- *Who/which components use or need the service?*
- For the service requester, the provided *service* is most important, and not how it is implemented (principle of information and implementation hiding)

Service provider ("server")

- *Who/which components implement or provide the service?*
- is responsible for hosting the service, and ensuring the promised QoS
- may charge for service usage

Qualities of Service (QoS)

- *What are the parameters that allow to distinguish good service provisioning from bad?*
- Examples: Reliable, predictable execution, cost, execution time, level of privacy, other guarantees

Terms and Definitions

Interface (Definition)

- An *interface* constitutes the specification of a service, that is implemented by a certain component. The interface defines a contract, to which the component that implements it has to comply.
- Interfaces **can be** described using formal languages

  Web Services Description Language (WSDL)

  OMG/ISO Interface Definition Language (IDL) (for CORBA)

  UML Object Constraint Language (OCL)

  But also: Java, C++ headers, . . .
- Type-safe interfaces sometimes introduce tight coupling

  Web Services don't force you into type-safe interfaces
  - Different message types may be acceptable to a service

Terms and Definitions

Software Architecture (Definition)

Software architecture encompasses the set of significant decisions about the organization of a software system

- selection of the *structural* elements from which the system is composed, and the interfaces to these
- *behavior* as specified in collaborations among those elements
- (de)*composition* of these structural and behavioral elements into a larger system
- architectural *style* that guides this organization

Mary Shaw
(Carnegie Mellon Univ.)

Terms and Definitions

Architectural Style (Definition)

- An *architectural style* defines a family of systems in terms of a pattern of structural organization [Garland/Shaw 96]
- An architectural style defines:

  a *vocabulary of design elements*
  components (client, server, filter, layer, adapter…), and
  connector types (pipe, broadcast, queue,...)

  a set of configuration rules (constraints) on how they can be combined
- Example styles in Software Architecture: Event-based, Repository-based, virtual machines, layered
- Good reference: Martin Fowler book on Enterprise Integration Architecture – introduces notation for architectural components of enterprise systems

Terms and Definitions

Service-Oriented Architecture (SOA)

- The architectural style is ***service-oriented*** if:

  It is not monolithic; common blocks of functionality are broken out of the applications and are instead provided by services
  - A significant part of the overall functionality is implemented by services, which exist otherwise independent of the application

  Design elements for an SOA are:
  - Components: services (can be composites), consumers, providers
  - Connector type: (remote) service invocations

  Configuration rules for an SOA are:
  - No strict layering (service implementations can use other services)
  - No centralized control entity
  - Services are designed for shared use, and for use that may not even have been anticipated at design time

Terms and Definitions

Service-Orientation

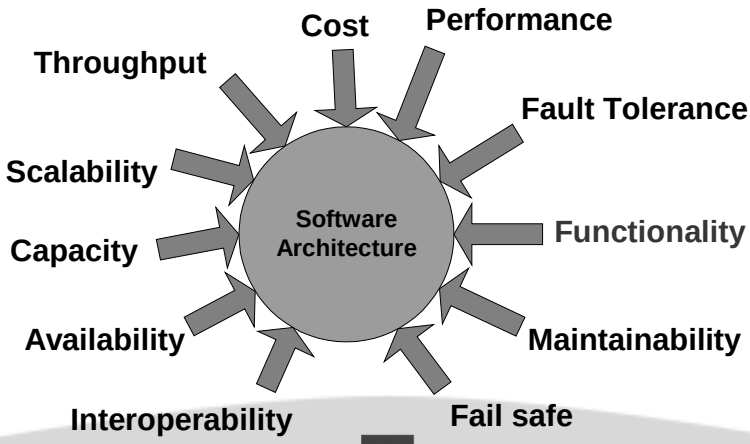
- *Service-Orientation* is an organizational principle
  - A set of principles for building large systems
  - It is not tied to any particular technology
- Examples:
  - Common “horizontal” services:
    - Logging, authentication/single-sign-on, systems management, Directory lookup of services, event notification
  - “Vertical” services, specific to your business domain
    - Product feature search service, Address management, Order Status Tracking Service, Truck/trailer tracking service
- As in organizations, there is always more than one way to structure a large system

Terms and Definitions
Quality criteria for (software) architecture

- Criteria to evaluate a decomposition:
  1. Derived from top rank use cases (adequateness)
  2. Balanced with existing assets: platform technology, frameworks, components
  3. Balanced with requirements (trade-offs, performance vs. security,…)
  4. Compliance with (domain-specific) industry standards and reference models (interoperability, readiness for merging)
  5. Designed to make the system more resilient to future changes (20 years?) (maintainability)
  6. Designed for substantial reuse, and with substantial reuse
  7. Intuitively understandable (people buy-in!) (usability)

Terms and Definitions

Forces and quality factors for software arch.



Challenges and problems

- Technology heterogeneity of existing applications
- Many integration projects during the last three years
  - Have been tactical, not strategic (no enterprise focus)
  - Only solved problems for one project (e.g. for one channel)

  Result: Stovepipe integrations
- Large organizations run 100s of apps and multiple ERPs
  - These systems were designed independently of each other
  - They overlap in functionality
  - They overlap in the data they manage

  Integration does not remove any overlap

  Consolidation would be better
- SOA helps to address these issues

Benefits of service-oriented design (1)

- More flexibility (“business agility”)

  Assumption: business process logic and business rules are no longer buried inside applications

  Result:
  - Since they are now explicit, processes can be changed easier
  - Existing services can be used in different contexts
  - Shorter time-to market for changed processes
- Reduced cost of operation through consolidation

  Assumption: Redundant functionality is eliminated

  Result:
  - Fewer servers
  - Fewer licenses
  - Fewer assets to manage
  - Lower maintenance cost

Benefits of service-oriented design (2)

- Higher quality
  - Eliminating redundancy reduces inconsistent data and behavior
  - More transparency
  - Improved system architecture – easier to understand
- Reduced risk, cost and complexity for development
  - Clean architecture ⇒ reduced cost and risk
  - Increased developer productivity through reuse
  - Projects can leverage existing services
  - “Black box” reuse instead of copy&paste reuse
- Lessen the dependencies on vendors
  - Service implementations can be replaced if interfaces stay the same
  - Services can be relocated from one platform to another
  - Services can even be outsourced to an external provider

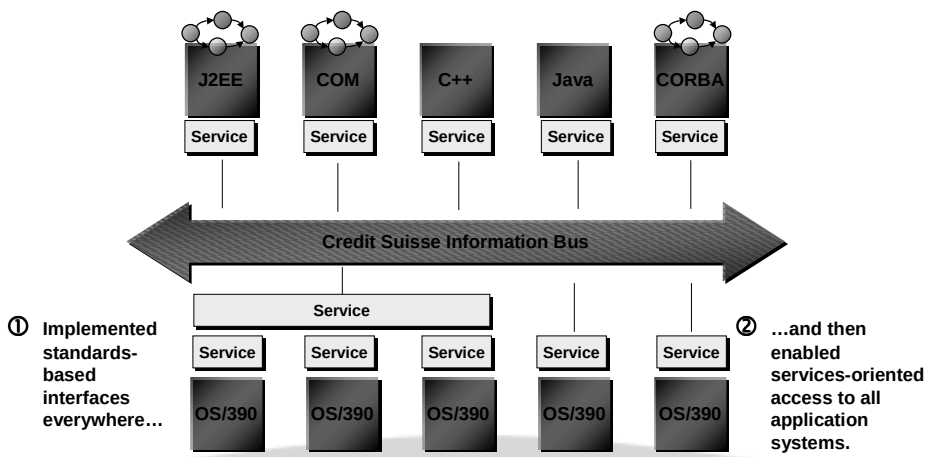
Benefits of service-oriented design (3)

- Good service design (partitioning) will outlive your middleware or implementation technology
  - All you have to do is to put a wrapper around it, if required
  - Many mainframe systems today provide many useful services that should be made available to applications elsewhere in the enterprise
- Commoditizing more and more parts of the IT infrastructure
  - Off-the-shelf infrastructure components are moving up the layers and coming closer to the application!
  - Due to existing industry standards and available products, developers stop building this stuff themselves:
    - 1990: DBMS, TP Monitors
    - 1992: Networking stacks
    - 1995: CORBA, RPC Middleware, Reliable Messaging
    - 1998: Naming Service, Publish and Subscribe, Event Notification
    - 2000: Various J2EE Services

Case Study

CREDIT SUISSE GROUP

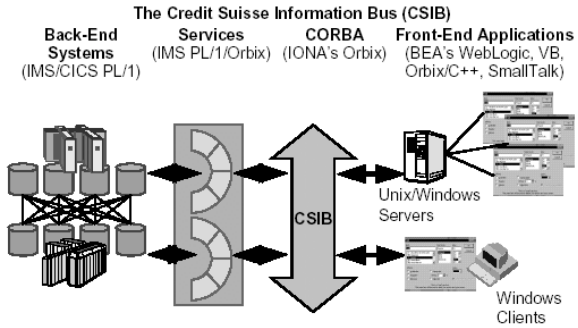
Credit Suisse's Enterprise Architecture Model



Case Study

Credit Suisse's Enterprise Architecture Model

- 1500 business service
- 50-plus front-end composite applications
- 100,000 users
- 7 million service invocations per week
- Based on CORBA and WebSphere MQ today
- Web services extension



"There is no need for us to dismantle our existing infrastructure to deploy on-line business opportunities. IONA enables us to leverage multiple technology generations in a flexible system, which ensures shorter development cycles and investment protection."

Stephan Murer, Credit Suisse

Summary

- Precise terminology helps
  - to understand and handle the problem
  - to identify and debunk unbaked concepts
- Service-orientation is an architectural style
- Web services are a good technology to build service oriented architectures
  - Simple, easy to understand
  - Inexpensive technology, no major investment needed
  - Can start small and proceed incrementally