

# Systems Integration Approaches

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Lecture 8&9

**Systems-Integration&Architecture**

## Systems Integration

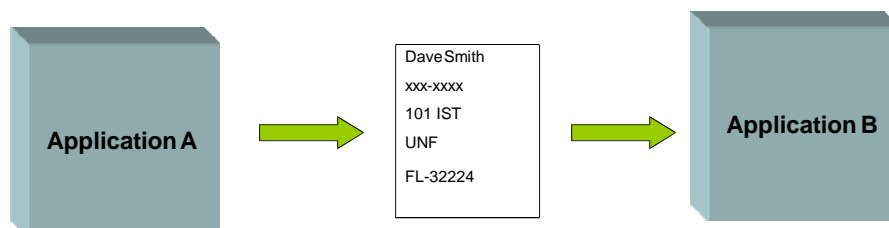
- Binds information systems
  - at information and service levels
- Supports information exchange
- Provides ability to do business in real-time
- Technical as well as strategic value
- Need integration solutions to support
  - Electronic markets, supply chain enablement, web visibility, customer relationship management (CRM)
- Success and value of application integration depends on
  - how well you understand the problem domain
  - the architecture you employ
  - technology you leverage

## Systems Integration Approaches

- Software applications can be integrated using different approaches
  - Information-oriented
  - Business process integration-oriented
  - Service-oriented
  - Portal-oriented

## Information-Oriented

- Integration of two or more systems by allowing simple exchanges of data between applications
  - Connecting databases
  - Deals with simple exchanges of data between two or more applications
  - Migrates data from source database to target database
- Disadvantage
  - Designers need to know all integrated systems in detail



## Information-Oriented: Example

- Moving information between systems may require changing both the content and schema on the fly



## Information-Oriented: Integration Concepts

- Coupling
  - Bind applications together in such a way that they are dependent on each other, sharing the same methods, interfaces, and perhaps data
  - Needs extensive changes in applications
  - If source or target system changes, corresponding changes required in coupled systems as well
  - Reusability
    - Allows common business processes to be reused
- Cohesion
  - “Act or state of sticking together” or “the logical agreement”
  - Applications and databases are independent of each other
  - Changes to source or target system should not affect others directly
  - Provides flexibility to integration
    - Allows addition, changes, and removal of systems without affecting integrated system

## Information Producers and Consumers

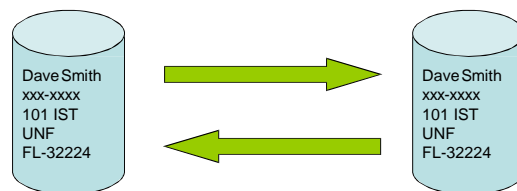
- Source and target systems are the entities that produce and consume information
- Types of systems that produce and consume information are
  - Database (integration using SQL, JDBC)
  - Application (API, adapters)
  - User interface (screen scraping)
  - Embedded devices (temperature sensors, call-counting machines)
- These systems are point of integration
  - since they are designed to produce and consume information

## Approaching Information Integration

- Steps to approach information integration
  - Identify the data
  - Catalog the data
  - Build the enterprise metadata model
    - This model will be used as master guide for integrating the various information stores that exists within the enterprise
- A successful integration solution requires the enterprise to define both how the information flows through it and how it does business
- Different ways to connect
  - Data Replication
  - Data Federation
  - Interface Processing

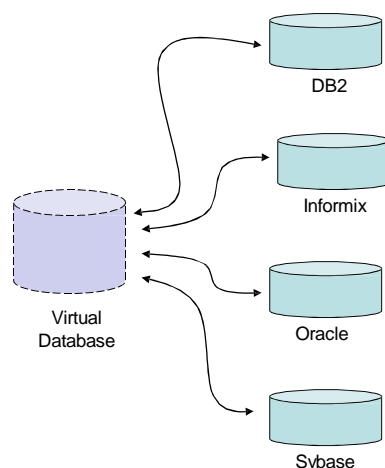
## Information-Oriented: Data Replication

- Moving data between two or more databases
- Accomplished by placing a software between databases
  - Extracts data from source database
  - Places data in the target database
- Advantage
  - Low cost and easy to integrate
- Disadvantage
  - Not suitable for integrating functions in applications
    - If methods are bound to data or shared along with data
  - Requires changes in source and target applications



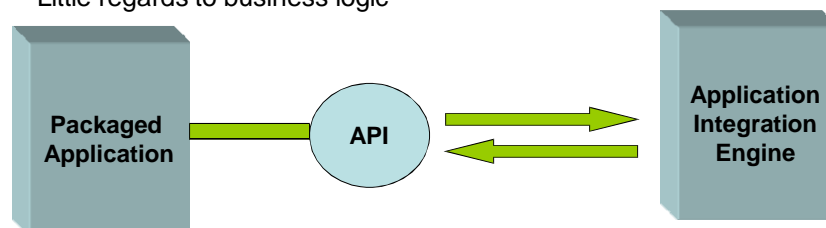
## Information-Oriented: Data Federation

- Integrating multiple databases into a single virtual database
- Application access virtual databases
  - Integration software handles the collection and distribution of the data to the physical database
- Advantage
  - Can integrate different types of databases
- Disadvantage
  - Interface between application and database need to be changed



## Information-Oriented: Interface Processing

- Integrating packaged and custom applications
  - Example: Enterprise Resource Planning (ERP)
- Adapters to connect custom and packaged applications
- Most popular integration approach
- Advantage
  - Efficient integration for commercially available software products
    - API solutions take into account for differences between schema, content, and application semantics when translating information to move between systems
  - Includes screen scrappers as points of integration
- Disadvantage
  - Little regards to business logic

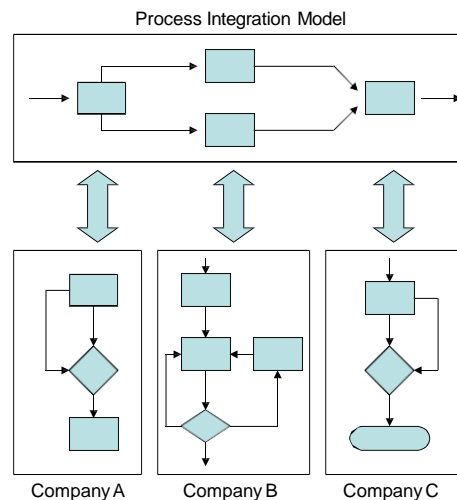


## Business Process Integration-Oriented

- The goal of business process integration is to allow integration not only by sharing information but also by managing the sharing of that information with easy to use tools
  - Focuses on coordinating or managing information flow between source and target applications
  - Focuses on process logic while separating application logic
- Defined as applying appropriate rules, in an agreed upon logical sequence, in order to pass information between participating systems, as well as visualize and share application-level processes
- It is the ability to define a common business process model that addresses the sequence, hierarchy, events, execution logic and information movement between systems
  - Central management of processes that exist on top of an existing set of processes and applications
  - Mechanism to manage movement of data and invocation of processes in order
  - Support for management and execution of processes that exists between applications

## Business Process Integration-Oriented

- Binds disparate processes and create process-to-process solutions
  - Automates tasks performed by humans
- Advantage
  - Supports information and control logic flow
  - Automates tasks performed by humans
- Disadvantage
  - Focuses on process flow and integration of processes only
    - Not on user interface, updating databases or executing a transaction

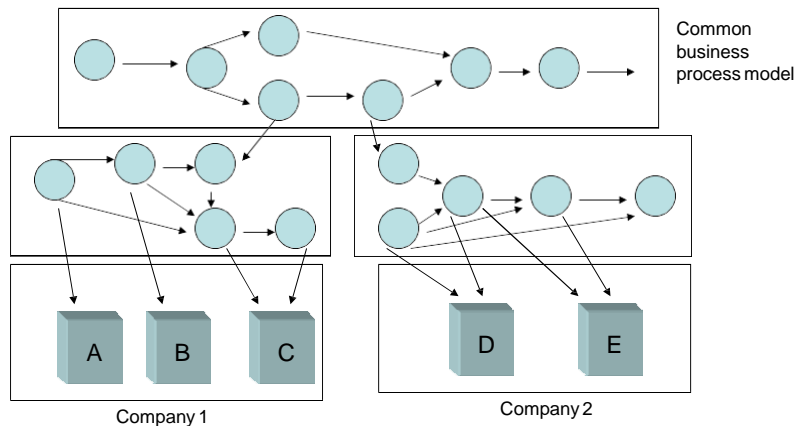


## Business Process Integration-Oriented Application Integration

- It is the ability to define a common business process model that addresses the sequence, hierarchy, events, execution logic and information movement between systems
- Idea is to provide single logical model that spans many applications and data stores
  - Providing the notion of a common business process that controls how systems and humans interact to fulfill a unique business requirement.
- Future of application integration
- Advantage
  - Supports information and control logic flow
  - Automates tasks performed by humans
- Disadvantage
  - Focuses on process flow and integration of processes only
    - Not on user interface, updating databases or executing a transaction

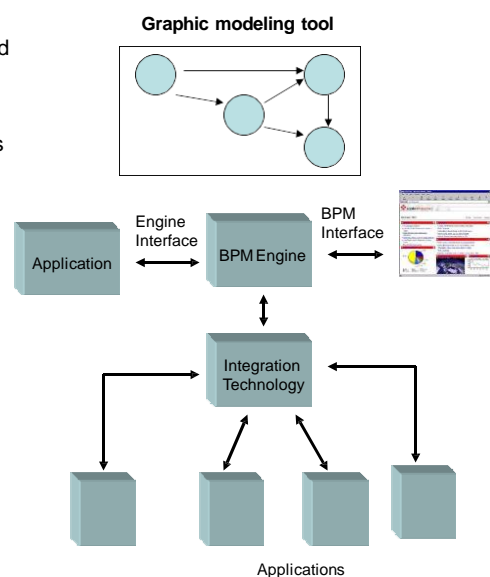
## Objective

- Provides control mechanism of sorts that defines and executes the movement of information and the invocation of processes that span many systems



## Technology Components

- Graphic modeling tool
  - Where business model is created and defined
- Business process engine
  - Controls the execution of the multi step business process and maintains state and the interactions with the middleware
- Business process monitoring interface
  - Allows end users to monitor and control execution of a business process in real time and optimize where needed
- Business process engine interface
  - Allows other applications to access the business process engine
- Integration technology (middleware)
  - Connects the source and target systems





## Technology Levels

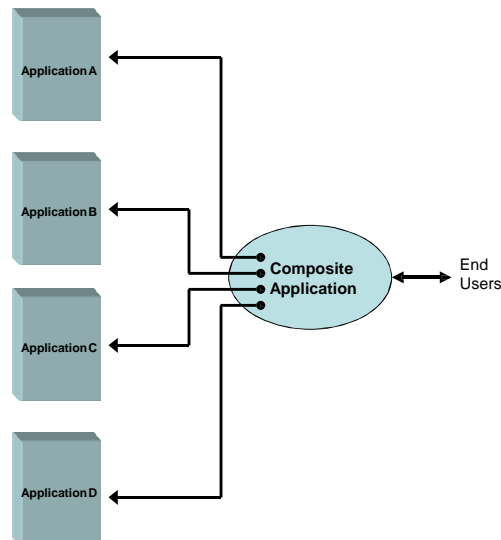
- Three levels of technology
  - Process modeling
    - Information movement is defined here
    - Components of models are
      - The common process model
      - Real entities, such as companies, organizations, or people
      - The source and target systems
  - Transformation, routing and rules
    - Information movement and formatting occurs here
    - Routing allows relevant information to be extracted from any source application, target application, or data store
  - Messaging service
    - Responsible for moving information between all connected applications

## Service-Oriented Application Integration

- Provides mechanism to bind applications together at service level
- The goal is to leverage power of Internet to provide access to remote application services through well-defined interface and directory services
- Web services is the technology to realize above goal
  - Web services is the future of application integration

## Service-oriented

- Integrates applications by allow them to share business logic and methods
  - Example: Web services
- Advantage
  - Allows reusability of applications
- Disadvantage
  - Need to change application logic
  - High cost for implementation

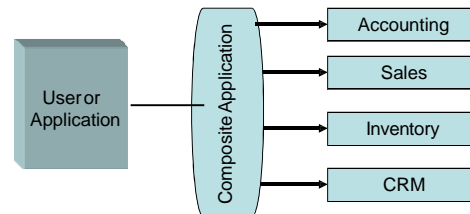


## The Basics

- Service-oriented application integration provides infrastructure for enterprises to share common application services as well as information
  - Infrastructure: Web services (distributed objects)
- A common set of applications services among enterprise applications invites reusability and as a result, significantly reduces the need for redundant application services and/or applications

## Application Service

- Application services
  - Subroutines or methods in applications
    - Something you invoke to make something happen
- Remote services that produces or consumes information
- Application services are composed together to provide composite applications made up of local and remote application services
  - Allows remote services to be invoked as if it is local service



## When to Leverage Service-Oriented Integration

- When two or more companies need to share common program logic
  - Such as calculation of shipping costs from a common supplier, which constantly changes
- When two or more companies want to share the development costs and the value of a common application
- When the problem domain is small and specialized, and is able to collaborate on a common application that all companies share
- Potential benefit of service-oriented integration is the simple binding of two or more applications in order to integrate both business processes and data

## Solutions Architecture

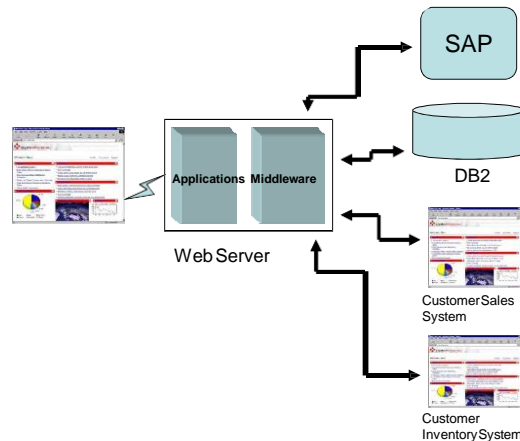
- Event-driven
  - Refers to those architectures that deal more with information movement than application service aggregation
  - Data moves from system to system in support of a particular business transaction, but there is also a requirement to access application services
- Composite-applications
  - Refers to those architectures that require application services to aggregate into a single instance of an application
- Autonomous-distributed
  - Refers to those architectures where web services are so tightly coupled that they appear as a single application
  - Binding applications together, inter and intra company, into a single, unified whole

## Portal-Oriented Application Integration

- Allows to view a multitude of systems (both internal and external enterprise systems) through a single user interface or application
  - Most often using web browser
  - Avoids back-end integration altogether
- Steps to create portal
  - Design portal application including user interface and application behavior
    - Portal application must be able to control user interaction, capturing and processing errors and controlling the transaction from the user interface all the way to the back-end systems
    - Application servers provide the interface development environment (IDE) for designing the user interface, define application behavior and back-end connector.
  - Determine which information contained within the back-end systems needs to be shared with portal application

## Portal-Oriented

- Integrates applications through single user interface or application
  - Mostly, through web browser
  - Externalizes information from multiple applications to a single application
- Advantage
  - No back-end integration
  - Ease of use (browser user interface)
- Disadvantage
  - Not real-time integration



## Portal Power

- Primary advantage of using portals is there is no need to integrate back-end systems directly between companies or within enterprises
  - Eliminates associated cost and risks
- Noninvasive approach allowing other organizations to interact with a company's internal systems through a controlled interface accessible over the web
- Faster implementation than other integration approaches
- Disadvantages
  - Information does not flow in real time, so requires human interaction
    - Does not automatically react to business events
  - Information must be abstracted through another application logic layer (e.g.: application servers)
    - This adds complexity
  - Security is a significant concern when enterprise data is being extended to users over the web

## Portal Categories

- **Single-System Portals**
  - Single enterprises that have their user interfaces extended to the web
    - Approaches: application servers, page servers, and technology for translating simple screens to HTML
- **Multiple-Enterprise-System Portals**
  - Extending single-system portal architecture to multiple enterprise systems
  - Application server architecture
    - Users are able to extract information from these systems and update them through a single web browser interface accessed over an extranet or over the web
- **Enterprise Portals**
  - Extending multiple-enterprise system portal to include systems that exist within many companies
  - Application servers are a good choice for enterprise, funneling information from the connected back-end enterprise systems

## Components of Portal Architecture

- **Web clients**
  - PC or any device that runs a web browser and is capable of displaying HTML and graphics
- **Web servers**
  - Web servers, at their core, are file servers.
  - They respond to requests from web clients, then send the requested file
  - Double duty
    - Serve file content to web clients
    - Perform rudimentary application processing
- **Database servers**
  - Respond to requests and return information
- **Back-end applications**
  - Enterprise applications existing either within a single enterprise or across many enterprises
  - Example: ERP systems
- **Application servers**
  - Provide middle layer between back-end applications, databases, and the web server
  - Communicates with both the web server and the resource server using transaction-oriented application development

## Next Generation

- Digital economy
  - Business runs within and between computers
  - Everything automated
  - Customers expect instantaneous access to information
- Application Integration
  - Competitive advantage
  - Ability to do business faster
  - Satisfy customer on demand
- Next generation integration
  - Integrate all disparate systems with a minimum impact on the applications and way of doing business
  - Adjustable to business needs
  - Quick deployment
  - Handle most business events electronically and in real time