Business Integration Patterns

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Yesterday and Today

- **Yesterday**
  - Focus on J2EE component development
  - Introduction to Model Driven Architecture as an approach to software design
  - Introduction to Service Oriented Architecture as an approach to system development

- **Today**
  - Focus on higher level business functions
  - Focus on component assembly
  - Focus on IBM tools to realize model driven architecture
  - Focus on implementation of service oriented architectures with IBM products
Agenda

- Brief Review
  - Service Oriented Architecture
  - The Business Process Management Vision
- What is Business Integration?
  - Why is business integration so hard?
  - Types of Business Integration
  - Understanding the principles driving best practices
- Emergence of Patterns in Business Integration
  - Process Integration – Understanding the basic building blocks
    - Business Object
    - Adapter
    - Mediator
    - Process Choreographer
- The IBM Business Integration Solution
What is a Service-Oriented Architecture?

- An approach to building distributed systems that delivers application functionality as services to end-user applications or to other services.

- A flexible and open architecture
  - Represent software assets as services
  - Integrate with applications outside of the enterprise
  - Well defined ways of representing and interacting with software components

- Software components become reusable building blocks
  - Focus on application assembly rather than development
  - Create new internal apps out of existing components
The Business Process Management Vision

- Process Requirements
- Process Modeling
- Interaction Glue
- Business Process Management Infrastructure
- Monitor
- Analysis
- Optimize
- Manage Execution
- Participate
- Existing Components
Business Integration Reference Architecture

IBM Software Offerings

Focus of today’s presentations

WebSphere BI Modeler

Development Platform

WebSphere Studio

Business Performance Management Services

WBI Monitor

Interaction Services

WebSphere Portal Server

Process Services

WebSphere BI Server

WebSphere BI Server Foundation

Information Services

DB2 Information Integrator

Enterprise Service Bus

WebSphere MQ

Web Services Gateway

WBI Event/Message Broker

Partner Services

WebSphere BI Connect

Business App Services

WebSphere Application Server

Application and Data Access Services

WBI Adapters

HATS

DB2 II Classic

Business Application and Data Services

Infrastructure Services
What is business integration?
Business Integration

Process Management - Business Process
- Business Manager View
- Focused on complex high-level business process flows
- Can have long-duration activities
- Likely to involve human interaction with process flows

Process Management - Sub-Process
- Business Analyst and System Architect view
- Focused on detailed micro-level hybrid data & info process flows
- Short and moderate duration activities
- Blended App-to-App and B2B services

Data Access, Transport, Transformation, Routing

Application Interaction
- Technical Manager view
- Focused on technical interactions
- Relatively simple sequences, transactional units of work
- IT & organizational infrastructure

Main Process
- Receive Order
- Check Credit
- Confirm Order
- Mail Invoice
- Mail and Ship
- Run Production
- Verify Inventory
- Determine Shipper

Sub-Process
- Determine Parts Needed
- Check Part A Availability
- Reserve Inventories
- Check Part B Availability

Basic Interaction
- Data Object: Warehouse App
  - Check for Part B at Warehouses
- Data Object: Inventory Sourcing App
  - Determine Least-Cost Sourcing
- Data Object: Transport App
  - Transform
  - Route
- Data Object: Transform App
  - Transport
  - Route
- Data Object: Route App
  - Transport
  - Route
Business integration project types

- Application to Application (A2A)
- Business to Business (B2B)
- Both can include Workflow (Human Interaction)
Point to point integration result: Chaos
Process integration project characteristics

- Few projects are green field. Typically projects involve integrating multiple applications implemented with different technologies on different platforms.
- There is an emphasis on re-use.
- Business process integration requires leveraging a mixture of interaction between systems, people, application code, and process centric business logic.
- Changes to one system tend to imply ripples of change at many levels to many other systems.
- Integration solutions extend beyond the internal boundaries of LAN / WAN to include trading partners.
Fundamental challenges

- Different applications / protocols
- Solutions are subject to constant change
- Developers have limited control and access
- Administration
- Monitoring
- Unreliable networks
- Slow networks
- High stakes
- Lack of standards
- Typically require cross team change management
Some specific requirements….

- Basic integration may require data/process dependent business logic on the “wire.”

  Consider object transformation or request routing scenarios

- Actions in one application need to be captured, translated and consumed by 1 or more other applications.

  Consider “order entry” scenario

- Cross application solutions require structural and value based translation.

- The relative timing of isolated actions in one application may be significant to other systems.

  Consider the “order cancellation” scenario

- Solutions need to provide reliability and recoverability in support of both long and short lived business processes.

  Activity sessions with compensation; last participant support; distributed transaction rollback.
General principles derived from experience and best practices

- Loose coupling
- High cohesion
- Non-intrusive
- Disconnected data
- Flow control
- Asynchronous interaction
- Synchronous interaction
- Publish – subscribe interaction

- Centralized administration and monitoring
- Brokered integration
Current Business Integration Architectures

- Traditional Custom-Coded Integration

- **Point-to-point integration**
- Data is mapped directly from one application to another
- Costly, unscalable and difficult to implement and maintain

**Internal Applications**
- Customer Service
- Finance and Billing
- Sales and Distribution
- Manufacturing
- Supply Chain Management
- Legacy

**External Applications**
- Suppliers
- Customers
- ASPs
- B2B Exchanges

21 interfaces
Current Business Integration Architectures

- Traditional Message Broker Integration

- Centralized point-to-point integration
- Data is mapped directly from one application to another
- Messaging Hub routes data

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21 interfaces
Current Business Integration Architectures

- Hub-and-spoke architecture
- Data isolation layer between applications and business process
- Common object model for process integration

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7 interfaces
Business process integration patterns
First some notation:

- Components
  - Business Data
  - Adapter
  - Mediation
  - Process
- Solution
- Application
Business object pattern
Generic and Application Specific Business Objects

- Business Object for representing and storing business data
- Superset representation (canonicalization)
- Application independent
- Support for simple and complex types,
- Support flat and hierarchical objects, top level and contained objects, and element descriptors
- Supports cross-referencing of hierarchical and flat objects

Diagram:
- Enterprise Resource Planning
- Legacy
- Generic Business Object
- Customer Relationship Management
- Supply Chain Management
- ASBO <> GBO translators
Business object illustration – online mall

Each application/process has its specific notion of a Customer object
The enterprise has a “federated” notion of Customer
Benefits of the business object pattern

- Simplifies the programming model for the business process integration.
  - Common data type
- Reduces the impact of schema changes at the applications
  - Business process integration is shielded from schema changes
- Provides a framework for create, retrieve, update and delete and other application specific operations.
  - Common verb set for business process integration
How do I track and communicate changes on business objects to distributed, loosely coupled components in a way that allows the components to understand the object structure and take the appropriate actions with the data?

- Use a business graph.

- Schema is passed by value with the business object and can be used when the object is de-serialized

- Attribute and object level change summary is also provided allowing for support of delta and after image modeling.
What is an Adapter?

- Isolates the application’s proprietary APIs or the technology’s standards
- Provides a consistent framework to expose external applications
- Provides bi-directional interaction
- Provides synchronous and asynchronous interaction
- With mediator – provides business object translation
How do I avoid constant revisions to adapters as I add additional business process integration scenarios or perform normal application upgrades?

- Use a meta-data driven adapter.

Meta-data driven adapter accommodates changes to the structure of existing data and allow the addition of new objects without changes to the adapter implementation.
How do I detect and process interesting events from my EIS when that capability is not provided out of the box?

- Use event notification mechanism

- Event call back based delivery, where notification for each event generated by the EIS is immediately passed to the adapter, is an alternative to poll based delivery.

- Pattern provides a high degree of flexibility for the flow of work out of the EIS.

- Could be prescribed by other QoS requirements like Event Sequencing.
Mediation
Mediation: Business Object Mapping

- Simple mapping can be used to manipulate attribute values, concatenate strings, do value based translations, convert data types, etc.

- More complex mapping can convert data structures such as multiple cardinality to single cardinality, iterative mapping and support for scripting.
Mediation: Handling Code Conversions and Resolving Key Differences

- Use a semantics manager

- With a generic business object model, relationships are maintained in the context of the generic id.

- Non-trivial cases include relationships with multiple participants and nested child business objects.
Relationship Example

- Allows multiple disparate applications to behave as a single application
- Provides static and dynamic cross-referencing capabilities
Process Patterns
Process Flow Representation

Think flow charts reinvented

Development tools support the easy creation and modification of the process flow.
The Business Process Engine

- Executes the process flow
- Maintains persistent state for long running flows
- Supports running multiple instances of the same business process
- Provides mechanisms for triggering the instantiation of a process, e.g.,
  - Arrival of a message on a queue
  - EJB method invocation
  - Service invocation
- Provides mechanisms for connecting to other service providers
Solution level patterns
How can I connect $N$ applications without creating the spaghetti of point to point interfaces?

- **Use an integration hub**

- **Process Integration Hubs:**
  - Broker – A message distributor hub
  - Process Integration Hub – Adds business process execution support
  - Exchange – A process integration hub which includes support for B2B integration (B2B Gateway or Portal)

- **Hub variant: Bus:**
  - A Hub may be physically distributed as a set of federated hubs
Pulling it all together
Remember Chaos?
Applying lessons learned

Use a hub:
Brokered generic business object model leveraging a process manager, loose coupling, efficient flow control, with Async. / Sync. processing

In the wire:
Asynchronous / Synchronous communication over messaging.

In the Endpoints:
Loose coupling, high cohesion, non-intrusive, leveraging data encapsulation, meta data and applying flow control principles

Monitoring & Administration:
Centralized Interface level views

Data Encapsulation
IBM Business Integration
Integration technologies

Application Server technologies

The middleware market is evolving as integration servers adopt open standards and application servers build out integration functionality.
Business Integration Reference Architecture
Business Integration Reference Architecture

Model  Design  Development Platform  Implement  Test

Process Monitoring  Business Performance Management Services  IT Monitoring

Interaction Services
- Delivery
- Experience
- Resource

Process Services
- Choreography
- Transactions
- Staff/Tasking

Information Services
- Federation
- Replication
- Analytics

Enterprise Service Bus
- Event
- Transport
- Mediation
- Transformation

Partner Services
- Community
- Document
- Protocol

Business Services
- Component
- Interface
- Core

Application and Data Access Services
- Event Detect
- On-Ramp

Business Applications and Data Services

Infrastructure Services

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Business integration pattern resources & references

IBM Redbooks
http://www.redbooks.ibm.com

IBM patterns for e-business

Enterprise Integration Patterns – Designing, Building, and Deploying Messaging Solutions.
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http://www.eaipatterns.com
Thank You.