Business Integration patterns

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V1.01 – May 2003
Defining the on demand organisation ...

“An enterprise whose business processes -- integrated end-to-end across the company and with key partners, suppliers and customers – can respond with speed to any customer demand, market opportunity or external threat”

— Sam Palmisano, IBM Chairman and CEO
Principles of an effective approach to BI:
Integration is a first class development activity
Connections are first class development artefacts

Effort=New Function

Effort=New Function + Integration

Effort=New Function + M x Integration

Dept LAN → Org WAN → Fire Wall → Inter Net → Fire Wall → DMZ LAN
Historical Trends - Proliferation of Integration Approaches

- EDI
- MOM
- RPC
- WorkFlow
- SCM1

1988

- TQM
- CORBA

1992

- BPR
- BPO

1996

- ERP
- CRM
- Process Stds
- BO Stds
- eHR
- emarkets
- ebusiness
- eprocurement
- ecommerce

2000

- LDAP
- XML
- EJB/DCOM
- Internet
- Web Processes
- Work Flow
- EJB
- DCOM
- CRM
- Work Flow
- Web Processes
- EJB
- Work Flow
- Web Processes
- eprocurement
- ecommerce

- BO Stds
- SCM2
- SRM
- ebod
- PLM
- eHR
- emarkets
- ebusiness

- BPO
- CRM
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- eprocurement
- ecommerce

- EDI
- TQM
- BPR
- BT

1988

1992

1996

2000

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Today’s MegaTrend: Business Integration (BI) and the interconnectedness-of-all-things

Today’s business problems require meta-integration of the historical stovepipe worlds of integration:

- Asynchronous and Synchronous Worlds
- IntraEnterprise (AI) and InterEnterprise (EE) Worlds
- Application, Data and Process Integration Worlds
- Procedural, Object Oriented, and Service Oriented Worlds
- Networking centric and Application centric Worlds

... preferably identifying and using the best from each

We need a unifying framework within which to reason objectively about the different worlds

... and which enables us to do it ‘on demand’!
The Problem of Redundant Complexity: Inter and Intra Enterprise Integration

- Example of Intra-Enterprise (AI or EAI) Integration
- Example of Inter-Enterprise (EE or B2B) Integration

- EE is AI with additional Inter-Enterprise concerns
- EE concerns will be reflected in a different weighting of QoS and commercial considerations compared with AI
- Nevertheless we should expect EE implementations to leverage a subset of AI patterns
The BI Vision faces a number of challenges …

- ‘Redundant Complexity’: Problem and solution patterns are often not well shared across domains
- ‘Humpty Dumpty Problem’: Overloaded terminology slows or inhibits cross domain dialogue
- ‘Devil in the Detail’: The use of similar looking solutions in different worlds may mask incompatibilities which only become apparent at lower levels of design
- ‘Middleware Theology’: Solution Architectures may be dictated more by prejudice than by reasoned argument
What we are delivering in the Revised Patterns for Business Integration

BI Design Approach

- A Patterns Based analysis/design approach for BI, designed for use within a wider methodology (eg GS Method)

BI Patterns

- An Organising Framework for BI Patterns
- Higher Order Fractal Patterns for Solution Design
- Associated Product Mappings and Red Books

BI Modelling Theory

- Universal (Cross Domain) BI modelling concepts
- Cross Domain Language Notation
- Extensions to UML (& P4eb) for BI

- Extensions to ADS2 MetaModel for BI
- Recursive Definitions to support Fractal Theory

Design
Patterns
Model
Section B1: Modelling Theory

Language Notation
### Example of terminology overload: “Synchronous vs Asynchronous”

<table>
<thead>
<tr>
<th>World</th>
<th>Meaning</th>
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<tbody>
<tr>
<td>Networking</td>
<td>Used to differentiate protocols which can detect transmission errors via acknowledgement messages</td>
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<tr>
<td>Application Programming</td>
<td>Used to indicate whether a the caller waits (blocks) until the operation completes</td>
</tr>
<tr>
<td>Messaging</td>
<td>Used to differentiate services which can store and forward messages (avoiding the need for all linkage services to be available)</td>
</tr>
<tr>
<td>Service Oriented Architecture</td>
<td>Used to indicate whether the invocation of a service requires a response</td>
</tr>
</tbody>
</table>
Domain Language Notation

Business Integration continuously faces the problem of overloaded terminology. A useful convention is to use Domain Language Identifiers to qualify terms, either to resolve ambiguity or just to improve precision.

Domain language identifiers in this presentation:

- P4eb = the language domain of “IBM Patterns for e-business”
- AI=[P4eb]Application Integration
- DI=[AI]Data-focused Integration
- EE=[P4eb]Extended Enterprise
- BI=[P4eb]Business Integration (not “Business Intelligence”) - includes AI and EE

Some examples:

- A [BI]Collaboration includes the concept of a [UML]Collaboration, and can be used to model [Crossworlds]Collaborations, and [Groupware]Collaborations
Section B2: Modelling Theory

Scenario Representation
Common Types of BI Use Case Requirement

- A needs something from B, C, D
  - Call based integration
- I need to get a message and data to B, C, D about something that happened in A
  - Message (Event) based integration
- I want to do A, then B then C to perform a business process
  - Process Composition
- If anything goes wrong I’d like the system to clean up any changes I made
  - Quality of Service (or Non Functional Requirement)
- I’d like the system resilient against any single point of failure
  - Quality of Service (or Non Functional Requirement)
Scenario Representation
1- Scenario Analysis

Collaboration Topology

A. Performance (inc Scalability)
B. Availability (inc Resilience)
C. Security
D. Transactionality
E. Standards Compliance
F. Operability
G. Federation
H. Dynamic/Autonomic (inc Caching)
I. Other

X. QoArchitecture & Product (inc Tooling)
Y. QoPartner & Relationship
Scenario Representation 2 – Collaboration Analysis

• A [UML]<Collaboration> encapsulates M-M activity in the most general sense between components of a distributed system.

• An <Interaction> focuses in on 1-1 or 1-M activity originating from a single operation execution.

Collaboration between Supply Chain Applications

A interacts with B, D, E requesting a quote
Scenario Representation
3 – Interaction Analysis

Complex interactions may be decomposed to show simpler constituent interactions.
A Context Flow Descriptor (shown by an ellipse) may be used to describe the Flows (Protocol Rules, Message Formats) and any Context which governs the overall interaction (e.g., session context).
Other details (synchronicity, call/messaging models) can also be shown as required.
Equally, any of these details may be omitted if not required.

A   B
All Details Omitted

A   B
Message Interaction

A   B
Synchronous Message Interaction
Scenario Representation
4 – ViewPoint Analysis

Different ViewPoints represent the scenario at different levels of abstraction, allowing the right level of detail to be exposed at the right time.

Application pattern

- Source Application
- Rules
- Target Application
- AppServer Services
- Collaboration Services
- Rules Directory
- Domain QoS Providers

Runtime pattern

Product mappings

- Product Service A
- Product Service B
- Product Service C

QoS Realisation Description

Hi Level QoS Requirements

Detailed QoS Requirements

Model

Patterns

Design
Components and the connections between them may be decomposed recursively until the right level of detail is reached.

Abstraction may be used to omit items of less interest, and to allow greater detail to be shown on remaining items.
Section B3: BI Modelling Theory

Connector Theory
Connector Subtypes – Adaptor and Path Connectors

A [BI]<Connector> provides connectivity between 2 other components. It is useful to distinguish two Subtypes:

- [BI]<Adaptor Connector> logical connectivity (may be contracted to <adaptor>)
- [BI]<Path Connector> physical connectivity

These subtypes are orthogonal, and may be composed. In general, a connector may therefore be both an adaptor connector and a path connector. Which details are explicitly shown in a model is a modelling decision.

[Diagram showing connectivity between components using Adaptor and Path Connectors]
Connector Subtypes – Adaptor Connectors

It is useful to distinguish 3 composable types of adaptor behaviour:

- **Data <Model Adaptors>** modify the semantic content, and normally require business input to define correct operational rules:
  - Splitting off a part of the data (projection/diminishment)
  - Joining external data (augmentation/enrichment)
  - Summarisation (aggregation/data reduction)
  - Translation of identifiers between domains (key management/matching)

- **Data <View Adaptors>** do not modify the semantic content, but do translate content in terms of its technical representation, using e.g.:
  - Element Demarcation & Tagging schemes – e.g. Record, CSV, XML
  - Element Sequencing schemes (Keys & Collation Sequences)
  - Element Encoding schemes (e.g. Character, Number, Date Formats)

  The two behaviours above may be composed to give a **<Data Adaptor>**

- **Flow <Control Adaptors>** are not concerned with content. They are concerned only with the activities involved in controlling flows:
  - Splitting, Joining & Sorting of multiple messages or flows
  - Wrapping messages in protocol packaging
  - Correctly interacting with a <path connector> component to execute a transport operation (respecting the flow protocol rules)
In this variation the adaptor functionality between S & T is decomposed into two parts. Each adapts to and from a common intermediate standard X. If there are multiple P2P connections between a group of components, this approach can significantly reduce the number of different adaptors required. A connected set of X-type adaptors may be called a (X-type) <bus> (emerging pattern).

The pattern may be applied recursively to obtain a ‘stack’ of coupling adaptor pairs over ‘virtual’ connections – this is a common pattern with <flow control> (protocol) adaptors.
Common Examples of Connection Modelling

- S type: AppServer Services to Adaptor Connector
- T type: Path Connector to AppServer Services
- X type: Adaptor Connector to Path Connector
Section D: BI Patterns
Classification of Interactions - Definitions

1) In a <parallel> interaction, the originating operation starts a set of sub-interactions some of which can run concurrently. <Pure parallel> interactions (ie all sub-interactions potentially concurrent) are good candidates for grid computing techniques.

2) In a <serial> interaction, the originating operation starts a set of sub-interactions which include execution dependencies (eg T2 cannot start until T1 completes).
BI Pattern Framework – Intra or Inter-enterprise

**Serial Interaction**

<table>
<thead>
<tr>
<th>No</th>
<th>Yes</th>
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<td>Focus: Controlling a Single Series of Operations</td>
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</tr>
<tr>
<td>Focus: Adapting and Transporting Messages on a Single Path</td>
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**Parallel Interaction**

<table>
<thead>
<tr>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus: + Starting, Splitting &amp; Joining Multiple Series of Operations</td>
<td></td>
</tr>
<tr>
<td>Focus: + Switching, Splitting &amp; Joining Messages on Multiple Paths</td>
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</table>

- S: Source
- T1, T2, T3: Targets
Application Integration application patterns

<table>
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<tr>
<th>Serial Interaction</th>
<th>Parallel Interaction</th>
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<tr>
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<td>Variation: Serial WorkFlow</td>
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<tr>
<td></td>
<td>S</td>
</tr>
<tr>
<td></td>
<td>T1</td>
</tr>
<tr>
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<td>T2</td>
</tr>
<tr>
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<td>T3</td>
</tr>
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</tr>
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<td>Variations: Message/Call Connection</td>
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<tr>
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<tr>
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<td>T</td>
</tr>
<tr>
<td>Yes</td>
<td>Parallel Process</td>
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<td>S</td>
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<tr>
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<td>T1</td>
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<td>T1</td>
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Parallel Interaction

Serial Interaction

Direct Connection

Variations: Message/Call Connection

Serial Process

Variation: Serial WorkFlow

S

T1

T2

T3

Parallel Process

Variation: Parallel WorkFlow

S

T1

T2

T3

Broker

Variation: Router

S

T1

T2

T3

Serial Interaction

No

Yes

Parallel Interaction

Serial Interaction

No
Extended Enterprise application patterns

- **Exposed Serial Process**
  - Serial Process Rules
  - T1
  - T2
  - T3

- **Exposed Direct Connection**
  - Variations: Exposed Message/Call Connection
  - S
  - T

- **Exposed Broker**
  - Variation: Exposed Router
  - Broker Rules
  - T1
  - T2
  - T3

**Serial Interaction**
- Yes
- No

**Parallel Interaction**
- No
- Yes
Direct Connection application pattern

- Simpler Direct Connections may not have any modelled rules associated with them.

However more complex connections will often have associated business rules. In traditional implementations these often needed to be translated from business input into technical rules, but increasingly business rules may be specified directly, and translated via system policies.

Business input will typically be required to properly configure:
- Security rules
- Transactional rules
- Autonomic rules (where specified as executable rules) eg priority, capacity, availability
- Business Data Mapping rules (for Adaptor Connectors)
The Rules Directory and QoS Providers may or may not be present. If they do, it is a modelling decision whether or not to show them in the diagram.

A standard pattern of Path Connectors (Firewalls and Network Infrastructure) is shown, although variations exist with less or more firewalls.

The remaining connector is primarily concerned with logical connection of the AppServer to the Path, and will therefore often be modelled as an Adaptor Connector.

Less secure Applications and connectors may be placed within the Demilitarised Zone, dependent upon local security policies, but the norm is as shown in these diagrams.
Direct Connections::Runtime pattern::Product mappings for path focused connections

Message Variation:
- AppServer Services
- WAS JMS Send
- Websphere Data Interchange
- WBI-C

Message Connector
- MQ
- SOAP Messaging Connector
- EDI VAN
- AS2

AppServer Services
- MQ Get
- Partner EDI Infrastructure
- Partner EDI-INT Infrastructure

Call Variation:
- AppServer Services
- WAS JCA
- WBI-C

Call Connector
- CICS Txn Gateway
- WAS SOAP Provider
- WBI-C ICS
- WBI-C WSGW

Partner Web Service Infrastructure

Under Partner Governance

Model

Patterns
Direct Connection::Runtime pattern::
Product mappings for coupling adaptor connections

Message Connection over Websphere ICS

Call Connection using WSGW pair to mediate non-WS call over WS connection
Parallel Process::Runtime pattern::Product mappings

<Parallel Process Manager>:

- Parallel Process Rules
- AS
- AS1
- AS2
- AS3

[PI]
- MQ Put
- MQI
- DBMS LDAP

[EE or PI]
- WS Client
- MQWF
- WAS Process Choreographer
- EJB WebService DCOM

Also supports WorkFlow Variation
## Process Managers – Key QoS Differentiators

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<tr>
<th>QoS</th>
<th>MQI</th>
<th>ICS</th>
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Section E: Patterns Based BI Design – Case Study
UK Insurance Market

[P]=Domain Identifier for Polaris Solution

[P]Broker Application

Insurer
- Quote
- Accept Risk

[P]Broker Application

Insurer
- Quote
- Accept Risk

[P]Broker Application

[P]Broker Application
Outline Design – Iteration 1

[P]Broker Application
<Hub>
<ThirdParty>
[P]Polaris iMarket

Insurer
- Quote
- Accept Risk

Insurer
- Quote
- Accept Risk

[P]Broker Application

[P]Broker Application

[P]Broker Application
Outline Design – Iteration 3

Insurer – Quote Interaction

<Hub> <ThirdParty>

[P]Polaris iMarket

<Router> <Serial Process Manager>

Log
Validate
<Call Connector>
Stats

Quote

[EE]
Outline Design – Iteration 4

Insurer – Quote Interaction

- <Router> [WAS] WSGW
- <Serial Process Manager> [WAS] MicroFlow
- Log
- Validate
- <Call Connector> [J2E] JCA-CICS
- Stats
- Quote

[P]Polaris iMarket

<ThirdParty>
Section G: Summary and Conclusions
IBM BI Patterns for e-business are being reengineered to extend reach and value

...Updated to reflect important configurations of latest IBM BI products

...Equipping BI Architects with cutting edge tools for:
- Top Down and Cross Domain Solution Design
- Product Skills Transfer and Assimilation
- Product/Solution comparison and positioning
- Documentation and Communication of BI Knowledge
Do they work?

Foundation Technology Services
David Shefter, Director of Web Integration Services

Consultant benefit
Education accomplished in four weeks less than previous learning curve
Represents an educational saving of $6,000 per consultant
These four weeks are now billable hours boosting revenues by $20K/m

Customer benefit
Initial assessments now 40% faster
Implementations now finished 20% faster

Business benefit
Patterns are now a major selling point for FTS - expect WebSphere revenues to grow significantly in the next year
Where can I find out more?

“These patterns will give you the wherewithal to put your business online with a minimum of reinvention, expense, sweat, blood, and tears. “
John Vlissides
IBM T.J. Watson Research

“... I can recommend it to every level of IT professional--from the CIO down to the programmer."
Robin Bloor
CEO
Bloor Research

" If you are trying to figure out what your company can do to make the best use of the Internet, this is the place to start. "
Paul Harmon
San Francisco, California

ISBN: 1-931182-02-7
Patterns for e-business Website

Business patterns

Self-Service
/ App patterns 1-2 / WS Advanced
/ App patterns 3-4 / Various
/ App pattern 5 / WS Advanced + WMQSI
/ App patterns 5-6 / WS Enterprise + WMQSI
/ App pattern 7 / Personalisation Server

Collaboration
/ App patterns 1-4 / Packages

Information Agg.
/ App patterns 1-5 / Various

Ext. Enterprise
/ App patterns 1-5 / Various

Integration patterns

Access Int.
/ App patterns 1-2 / WS Portal Server, WES

Application Int.
/ App patterns 1-9 / Various

Composite patterns

eCommerce
/ App patterns 1-2 / WCS 5.1

eMarketplace
/ App patterns / WCS MPE

Custom designs
/ WS/Domino, WS/SAP, NFRs
Patterns for e-business Resources

A major source of IBM reusable assets

26 Mb Web site

24 Redbooks x 350 pps + 16 more in 2003

- Composite patterns
- Business patterns
- Integration patterns
- Application patterns
- Runtime patterns
- Runtime product mappings
- Redbooks containing:
  - Performance considerations
  - Technology options
  - Application Design guidelines
  - Application Development guidelines
  - System Management guidelines
- Practical references
- Pattern Development Kit
- Reusable integrated runtime platform (future)
- Generic solutions
- Business problem
- Any IBM supported platform
- Best practices
- Code

SG24-5864-00  Patterns for e-business: User-to-Business Patterns for Topology 1 and 2 using WebSphere Advanced Edition
SG24-5755-00  WebSphere Studio and VisualAge for Java Servlet and JSP Programming
SG24-5754- 00  Design and Implement Servlets, JSPs, and EJ Bs for IBM WebSphere Application Server
SG24-5514-00  CCF Connectors and Database Connections Using WebSphere Adv. Edition Connectors and M QSI, Patterns for e-business Series
SG24-6151-00  User-to-Business Patterns Using WebSphere Enterprise Edition: Patterns for e-business Series
SG24-6160-00  Users and MQSI, Patterns for e-business Series
SG24-6156-00  e-Commerce Patterns Using WebSphere Commerce Suite, Patterns for e-business Series
SG24-6158-00  e-Marketplace Pattern using WebSphere Commerce Suite, MarketPlace Edition, Patterns for e-business Series
SG24-6010-00  Business to Business Integration for Topology 2 and 3 using MQSeries and MQSI, Patterns for e-business Series
SG24-6213-00  User-to-Business Pattern Using WebSphere Personalization Patterns for e-business series
SG24-5999-00  User-to-Business Patterns using AS/400 (Deploying the U2B PDK on to WS/400 Advanced Edition)
REDP049  User-to-Business Patterns Systems Management Guidelines, Patterns for e-business Series
SG24-6166-00  Business Process Management using MQSeries and Partner Agreement Manager (PAM)
SG24-6213-00  User-to-Business Pattern Using WebSphere Personalization Patterns for e-business series
SG24-5999-00  User-to-Business Patterns using AS/400 (Deploying the U2B PDK on to WS/400 Advanced Edition)
REDP0127  Connect for iSeries with WebSphere Commerce Suite: BtoB Enabling a WebSphere Commerce Suite Web Site
REDP0514  Integrating WebSphere Commerce Suite With a Back-End Order Management Application

A major source of IBM reusable assets
BI Patterns Adoption Workshop

Goal: Evaluate the potential and applicability of BI Patterns in your environment
Format: 2-3 day workshop
Objectives:
- Provide an understanding of Patterns and their potential
- Model 2-3 of your scenarios using BI patterns approaches
- Evaluate applicability and develop a first cut adoption plan

Status: Pilot
For more details: paulv@uk.ibm.com
Where can I find out more?

Patterns for e-business on the Internet

Patterns Resources

Patterns for e-business: A Strategy for Reuse
– Published in October 2001 (ISBN: 1-931182-02-7)
– Publisher url http://www.mcpressonline.com/ibmpress/5206.htm
– Also available from Amazon, B&N, Fatbrain, Borders etc

Patterns Workshop email: paulv@uk.ibm.com
Questions ... and feedback

PaulV@uk.ibm.com

www.ibm.com/developerWorks/patterns/