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Enterprise Service Bus Overview

IBM WebSphere Software Platform for Integration

ESB Brokering Concepts & Solutions

Glen McDougall,

IBM Canada Ltd.

Version=01.UofT_ESBOverview_GlenMcDougall_06Feb07.ppt

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Agenda

- SOA & ESB Trends
- Broker Directions and Key Themes
- Getting Started with Version 6
- Migration and Coexistence
- Administration Improvements
- Graphical Mapping
- Java Compute Node
- ESQL enhancements
- Other New and Improved Nodes
- Web Services
- Message Modeling
- Performance Improvements
- (Platform coverage, SOE, reference material)
- Updates since GA
- Brokering Patterns

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IBM WebSphere Software Platform for Integration

ESB Introductory Concepts

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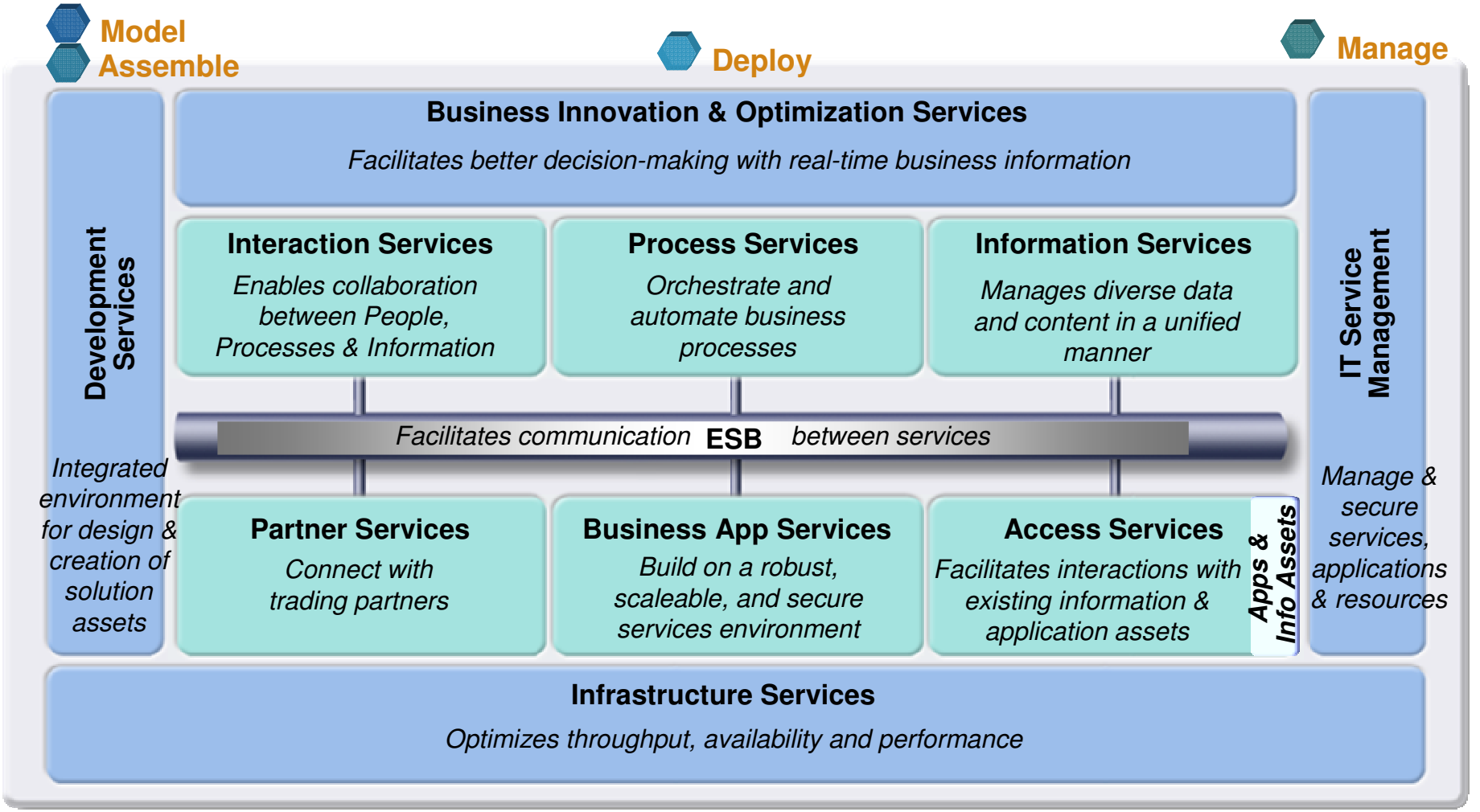
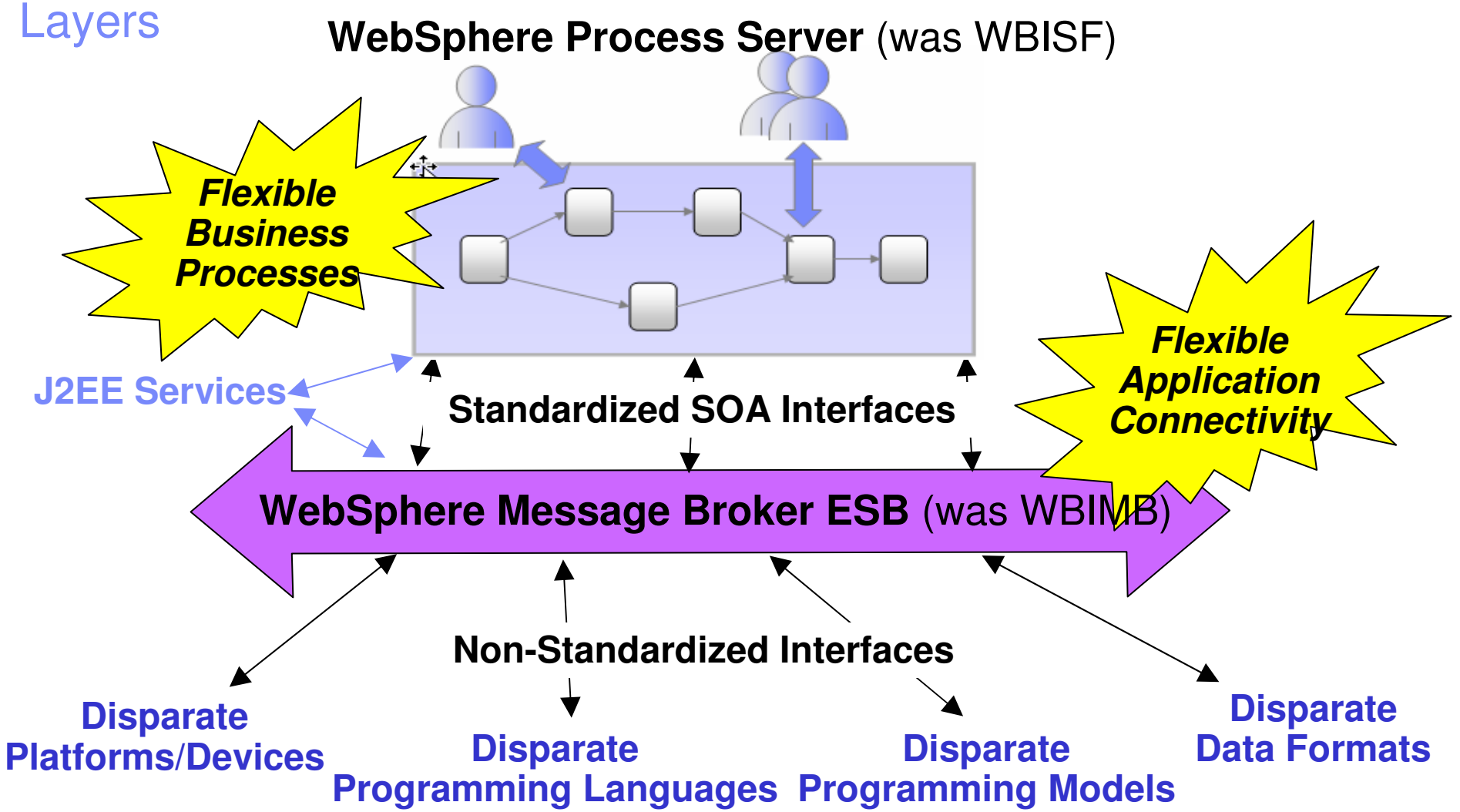
SOA Reference Architecture

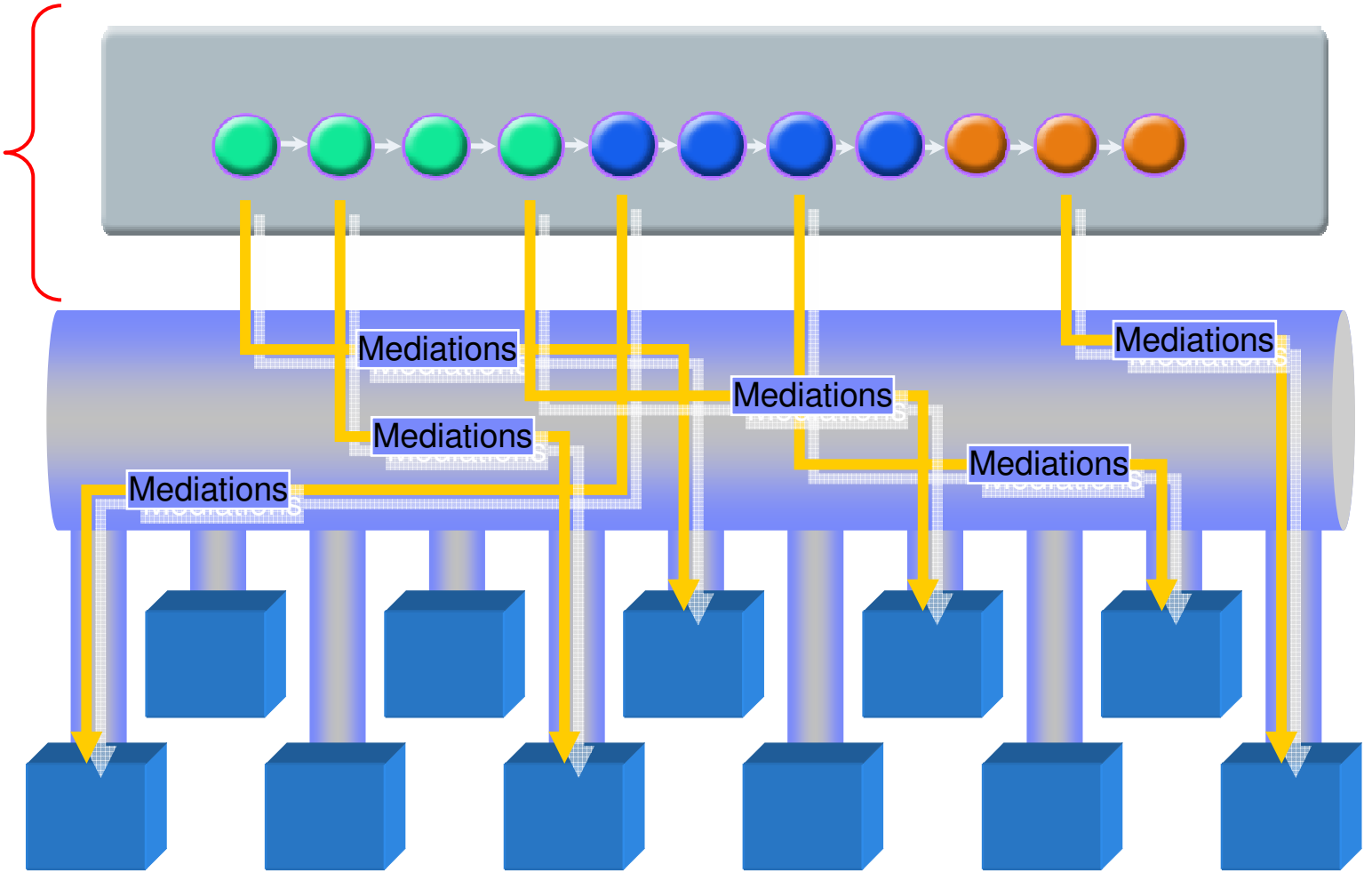


WebSphere Service Oriented Architecture with Process & ESB Layers

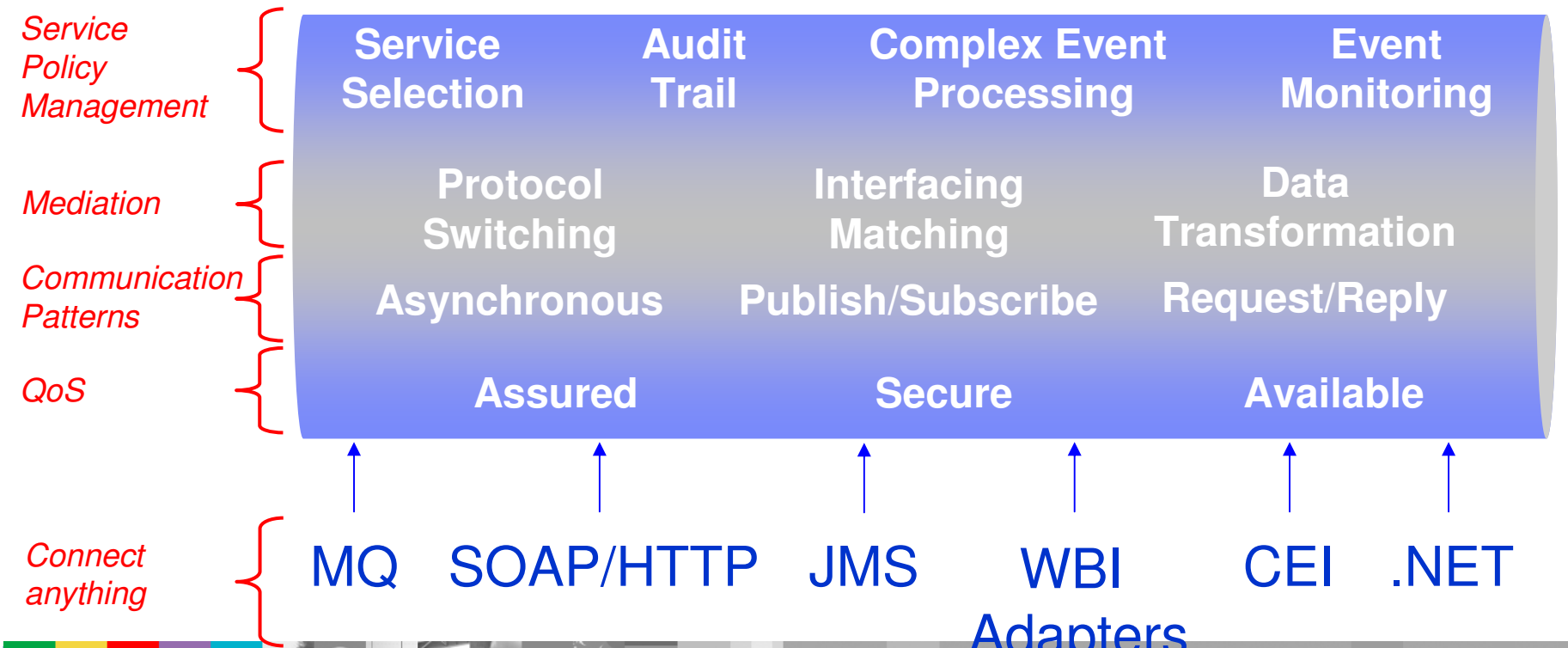


Process Integration Service Combination

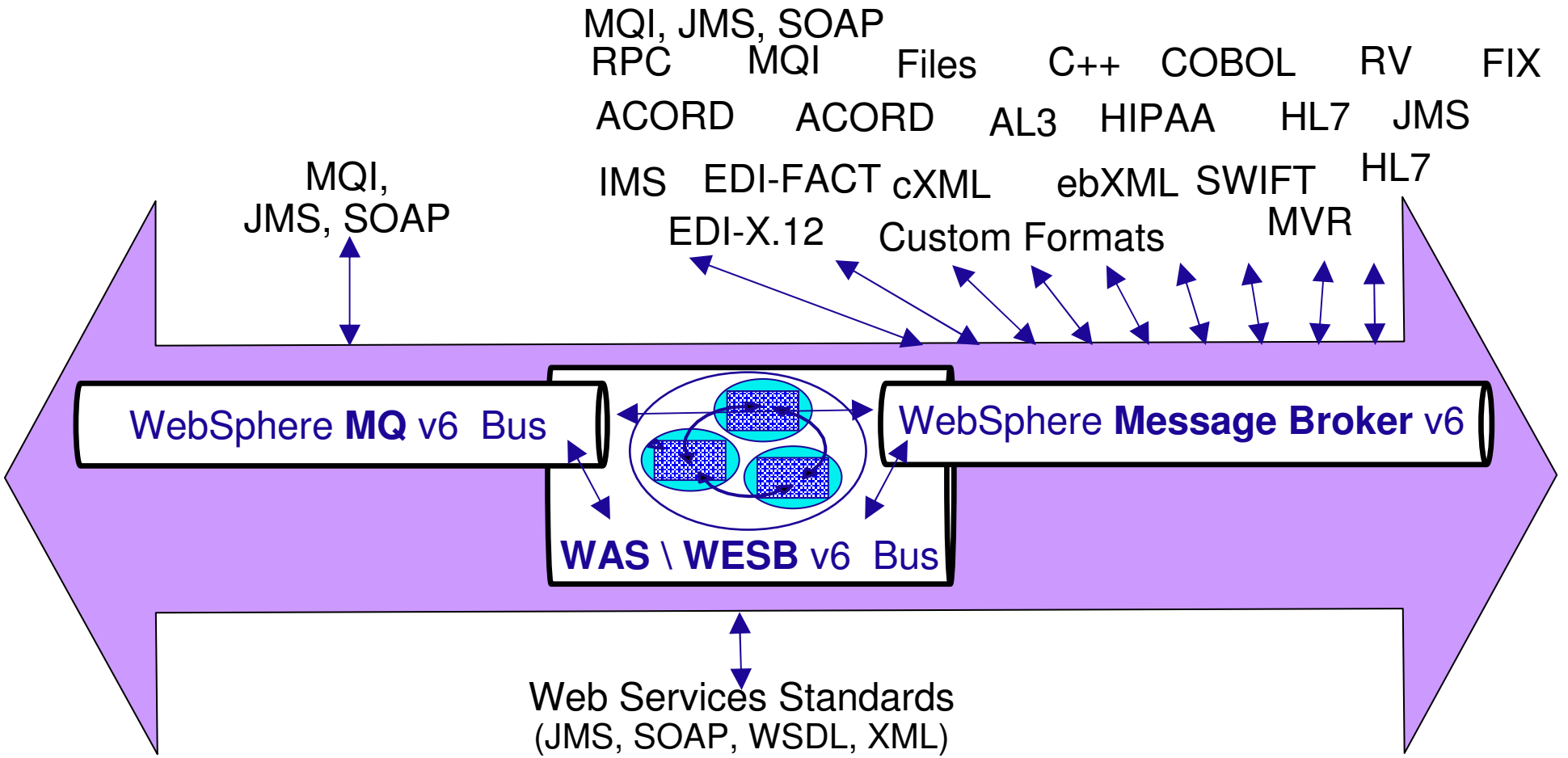
Process Integration Service Combination Framework



Aspects of the Enterprise Service Bus



ESB for Universal Application Communications & Transport



Messaging Fundamentals

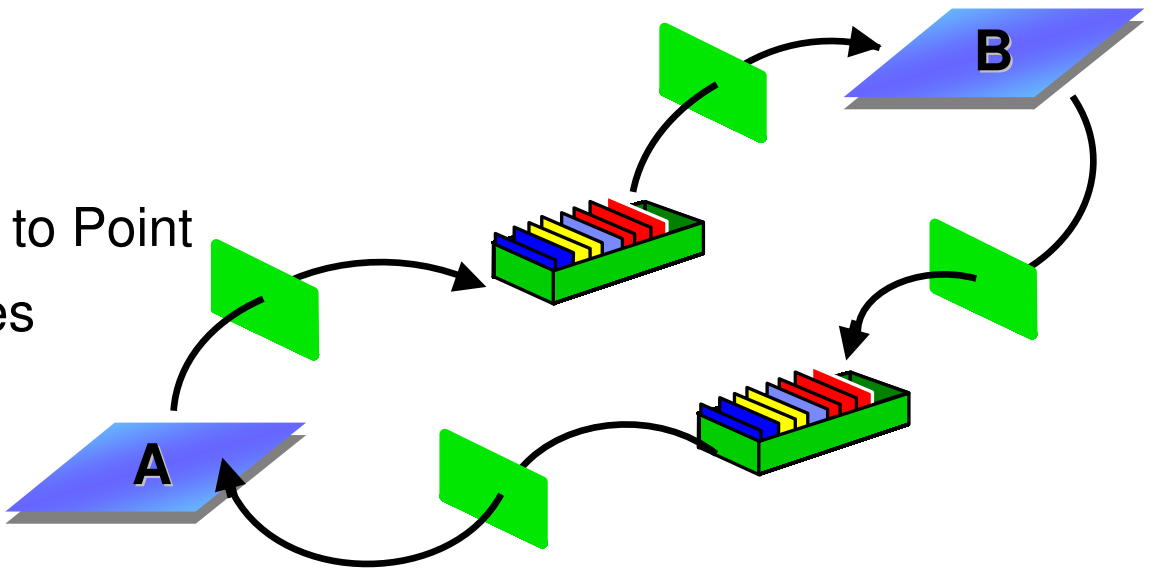
A single solution, with multi-platform APIs (JMS and MQI)
- Easy to use message centric interface
- Network independent
- Faster application development

Assured message delivery
- Exactly Once, Transactional

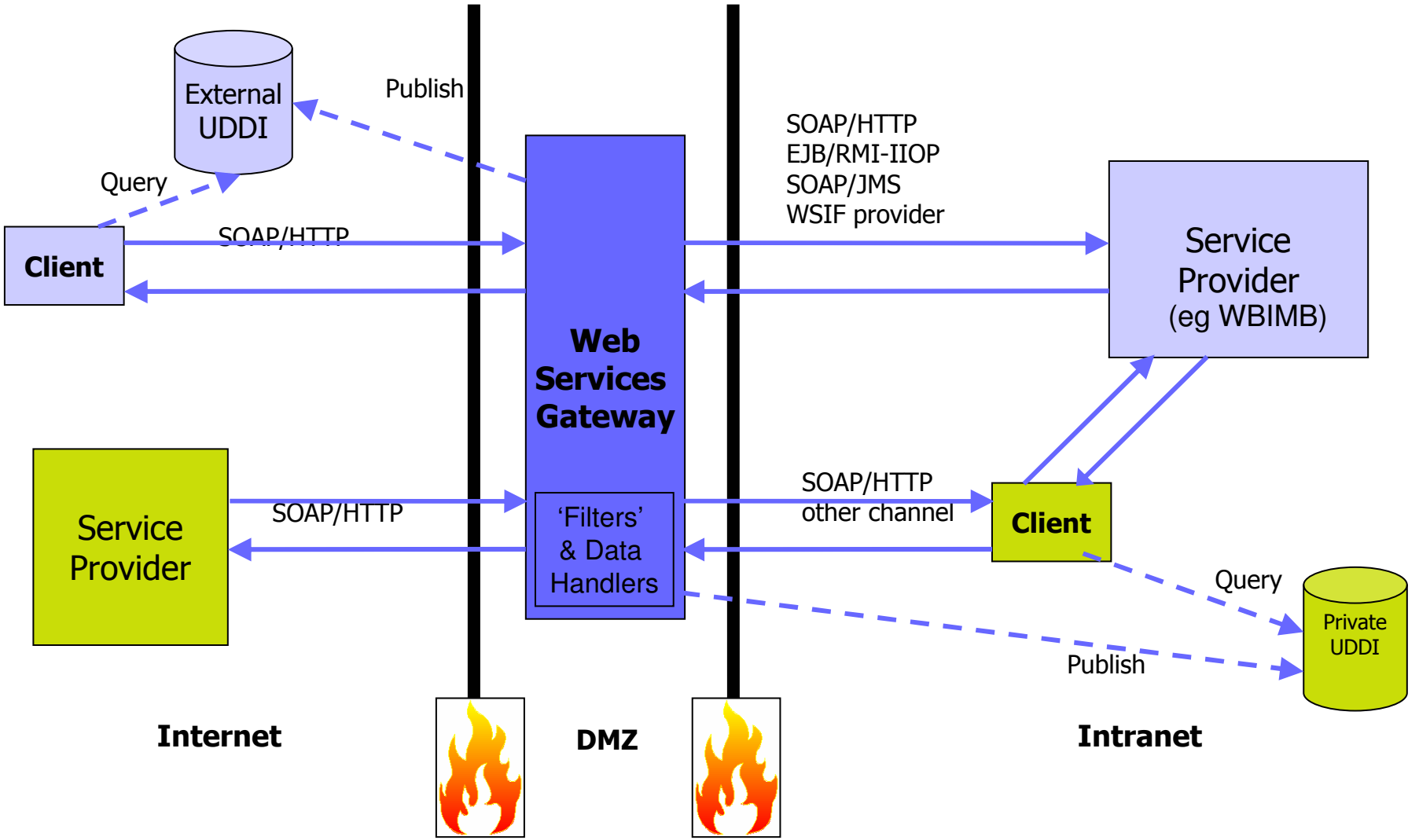
Loosely-coupled applications
- Asynchronous messaging
- Parallelism, Triggering

Scalable & Robust
- Publish\Subscribe or Point to Point
- Clustering, Large Messages

Pervasive



ESB Web Services Gateway Animation



Integrating the applications in your SOA

Enterprise Service Bus software from IBM WebSphere

Flexible connectivity infrastructure for integrating applications and services to power your SOA

WebSphere ESB: a new product delivering an Enterprise Service Bus

- Standards based connectivity including SOAP, XML, JMS, etc.

WebSphere Message Broker: a new version delivering an *advanced* Enterprise Service Bus

- Universal connectivity including SOAP, XML, JMS, COBOL copybook, SCADA, etc.
- Advanced message transformation, enrichment and routing

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IBM WebSphere Software Platform for Integration

WESB \ WPSv6 Concepts

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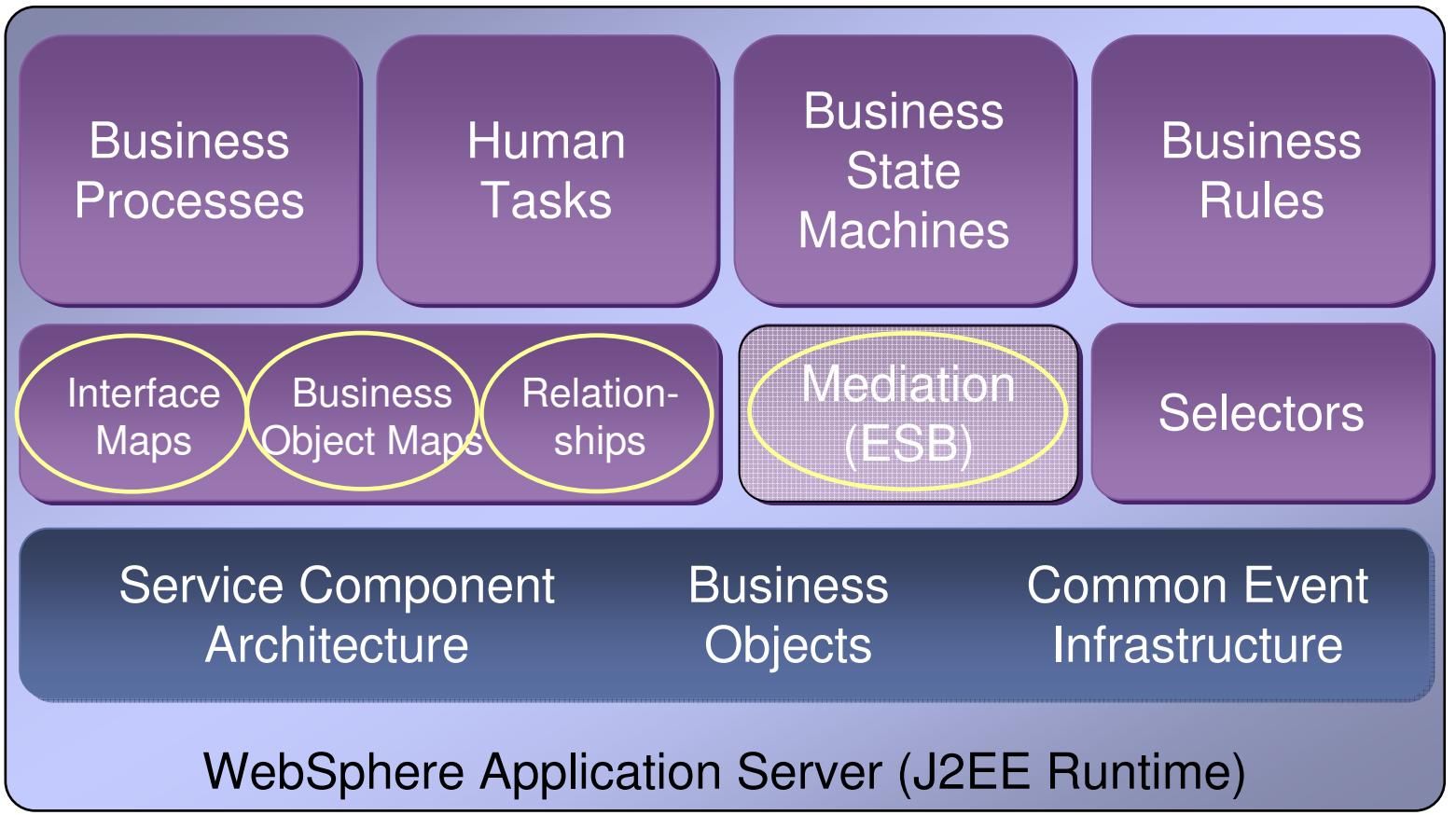
WebSphere Process Server V6

- WebSphere Application Server Foundation
  - Clustering, failover, high availability and robust platform
  - Single administration environment
  - Common Event Infrastructure – Process Management
- Service Oriented Architecture platform
  - A uniform invocation programming model (SCA)
  - A uniform data representation model (Business Objects)
  - Powerful tools to build and reuse standard components
- Powerful Staff Components
  - Participating / Originating / Ad-Hoc Tasks
  - Multi-level escalation
  - Client components out-of-the box (JSF)
- Business Processes
  - WS-BPEL standard
- Business State Machines, Business Rules & **Transformations**
  - Advanced services to build integration solutions
- A single Process Integration platform
  - Reduces complexity and administration cost

WebSphere Process Server V6 – Transformation and Mediation Components



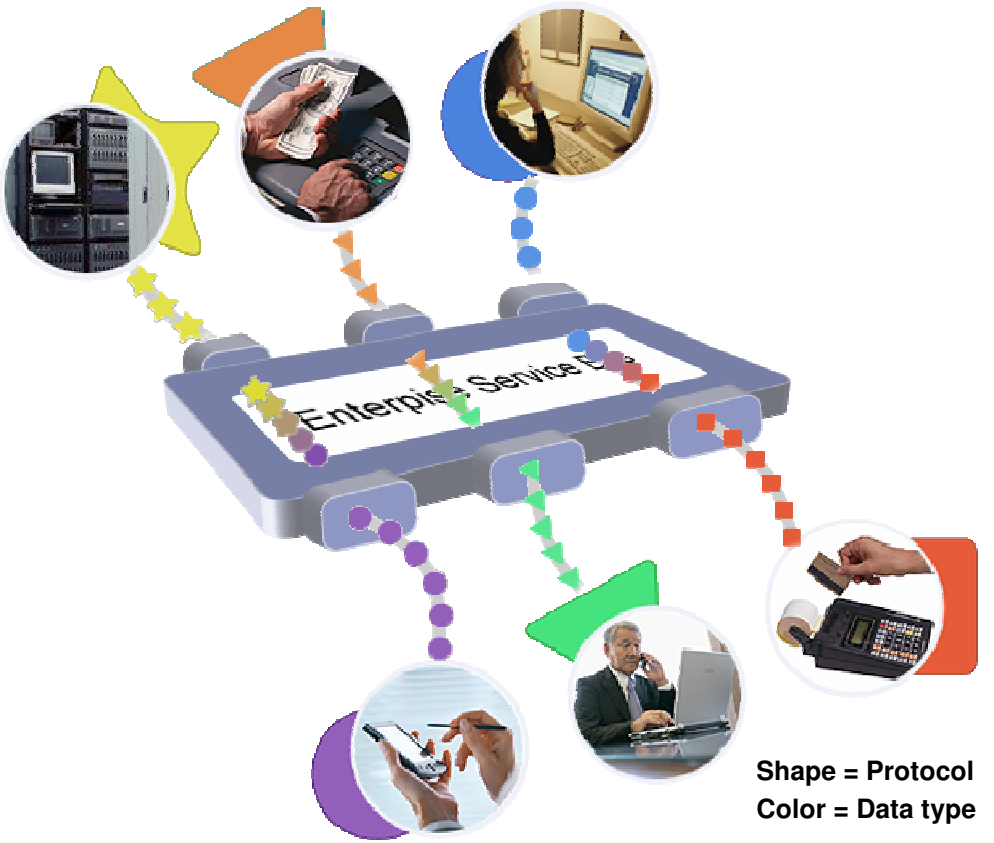
Common Connectivity: Enterprise Service Bus

An Enterprise Service Bus (ESB) is a flexible connectivity infrastructure for integrating applications and services.

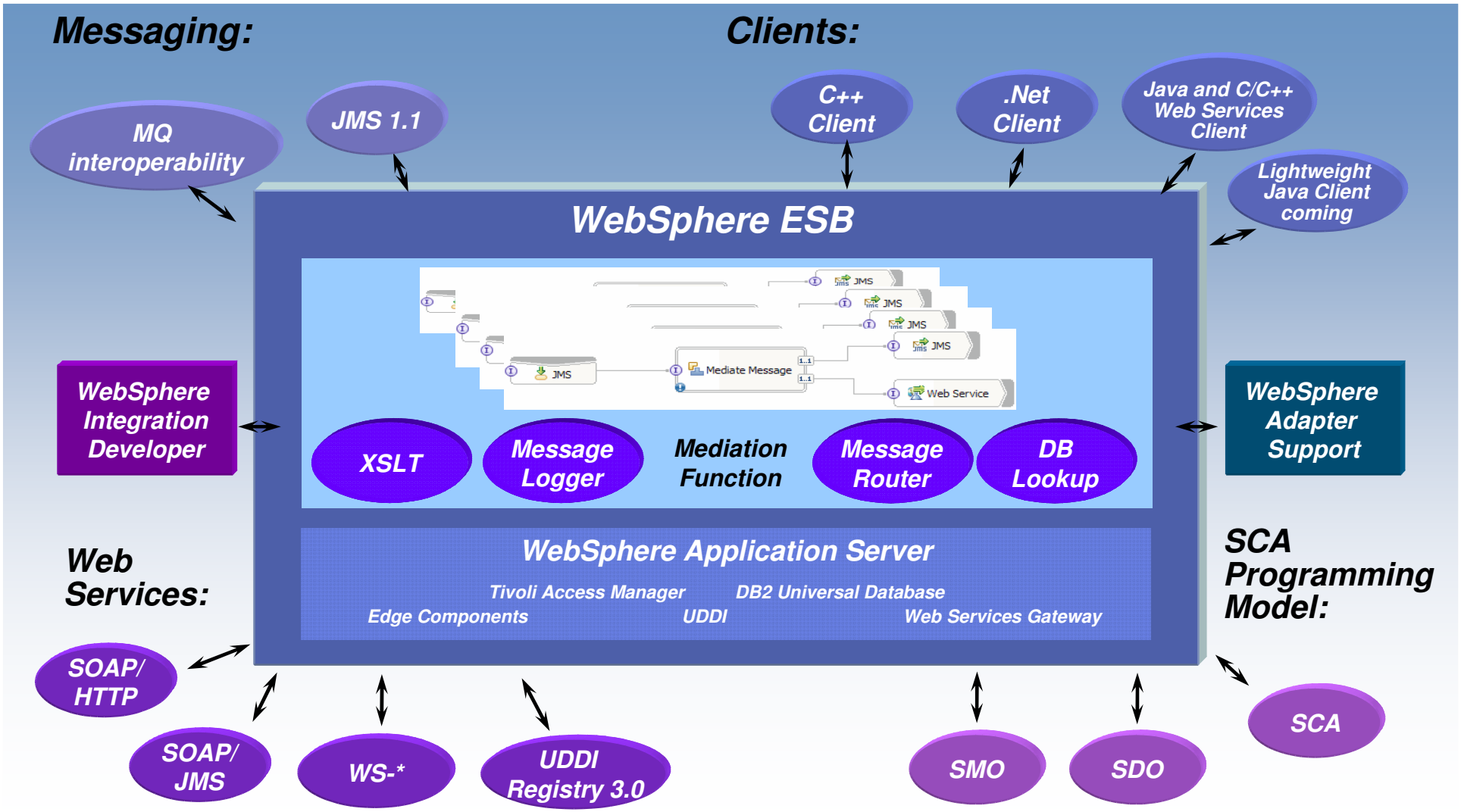
An ESB powers your SOA by reducing the number, size, and complexity of interfaces.

An ESB performs the following between requestor and service

- **ROUTING messages between services**
- **CONVERTING transport protocols between requestor and service**
- **TRANSFORMING message formats between requestor and service**
- **HANDLING business events from disparate sources**

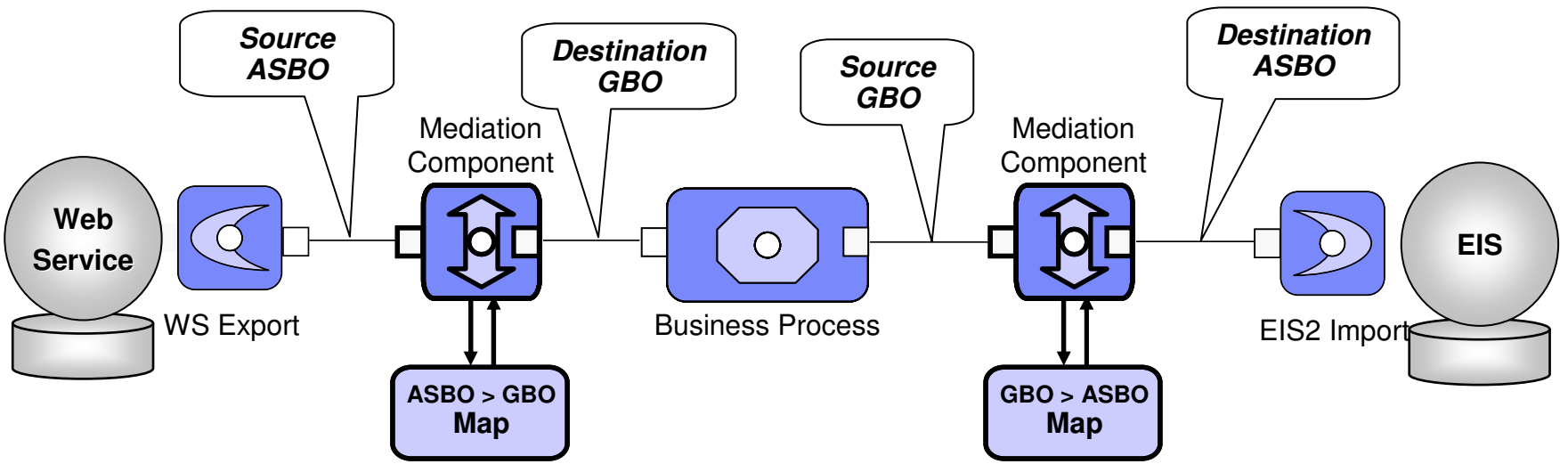


WebSphere ESB

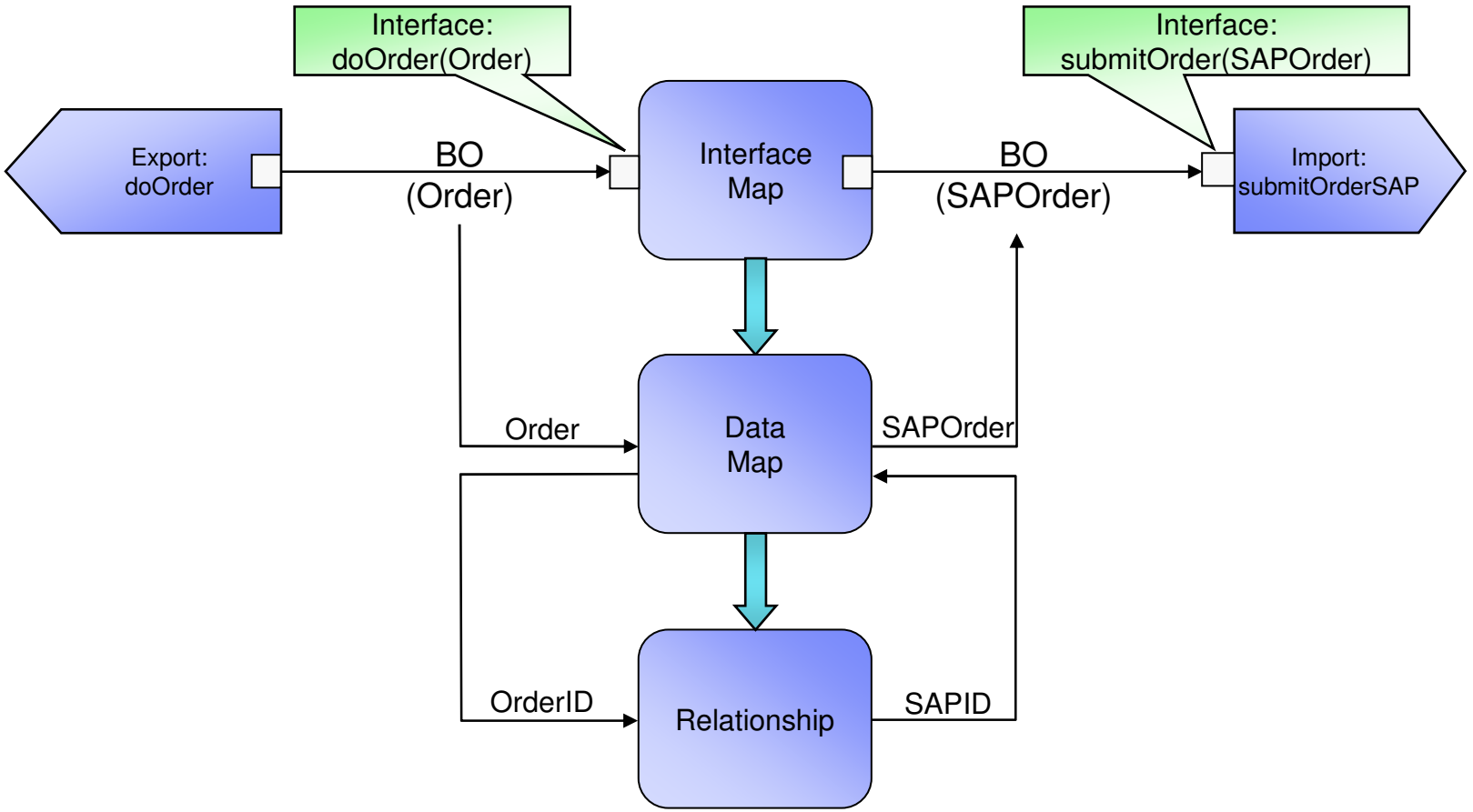


Mapping Architecture

- Mapping provides support for Business Objects & Graphs
- Invoked by any component that requires BO transformation
- Mapping provides support for the following capabilities:
  - Transforming the Change Summary / Event Summary
  - Utilizing the Relationship Service

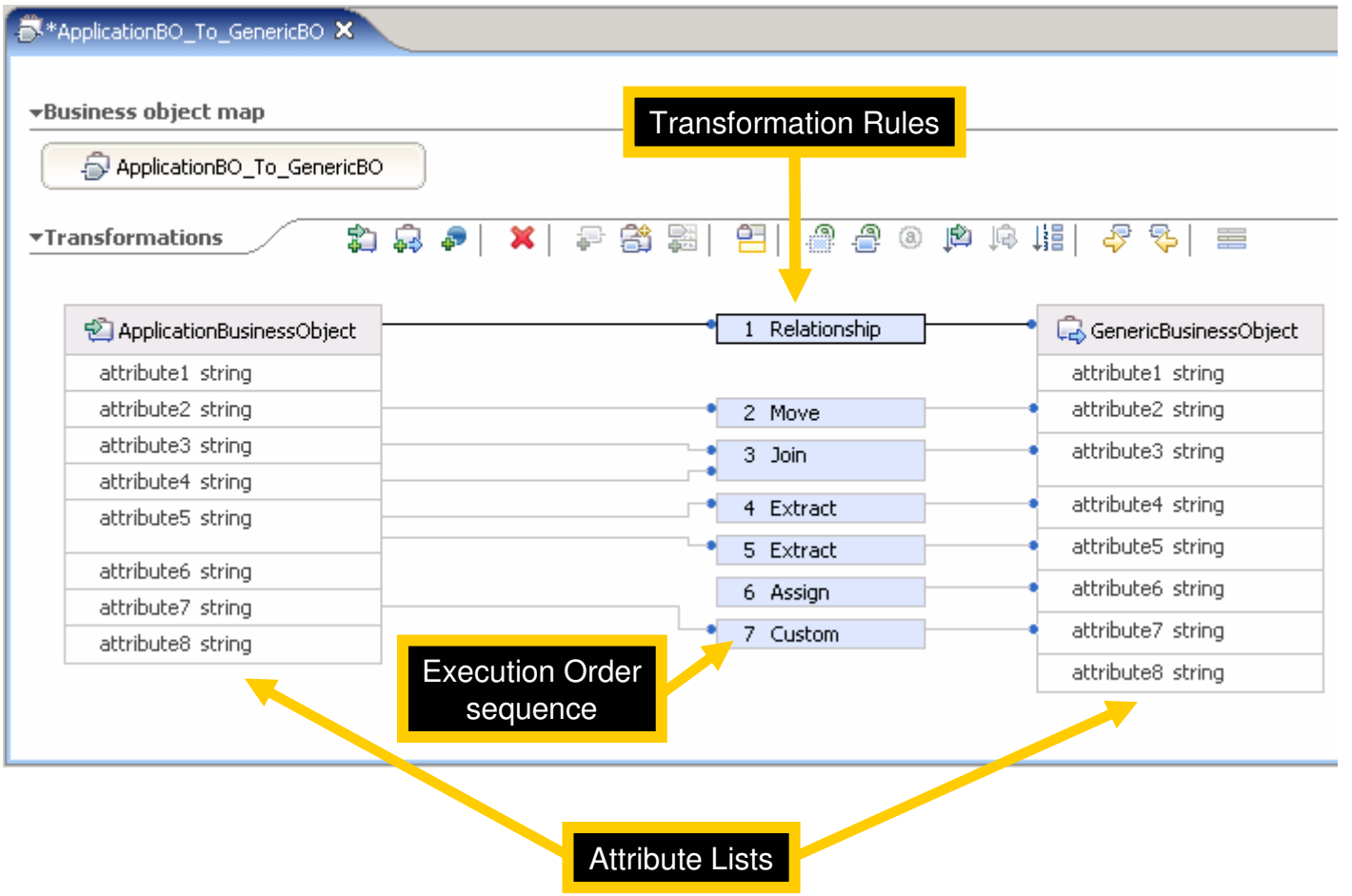


Transformation Components



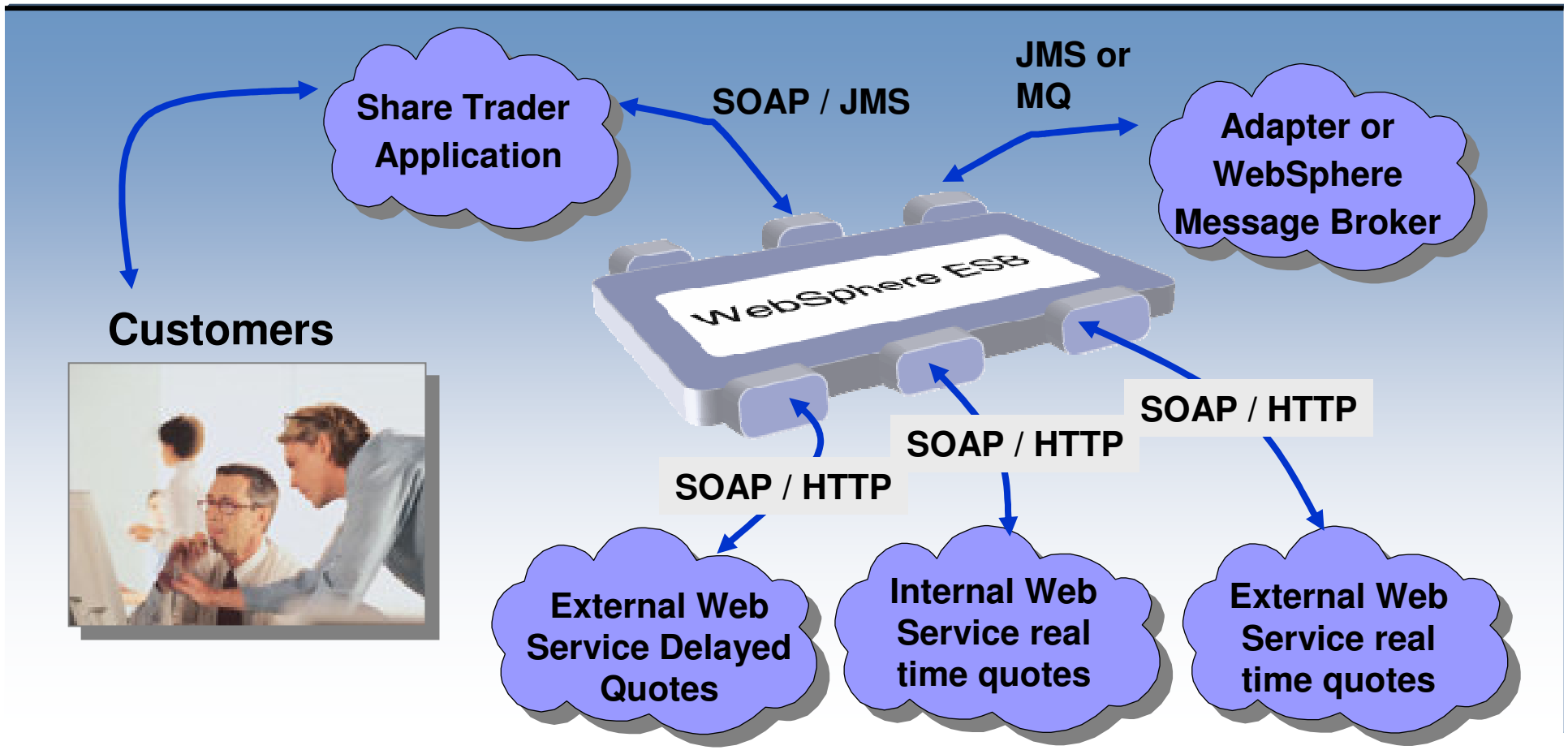
Transformation Rules

- Transformation rule defines a method of transferring data:
  - **Move**
  - **Join**
  - **Extract**
  - **Assign**
  - **Custom**
  - **Custom Callout**
  - **Custom Assign**
  - **Relationship**
  - Submap



Scenario 1: WebSphere ESB

Challenge: Share Trader Financial Services needed to roll out a new offering that required integration of multiple systems. Share Trader required a responsive Web Services infrastructure. The business also wanted to offer a higher service level to premium customers by providing real time quotes instead of delayed quotes.



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WMB Concepts

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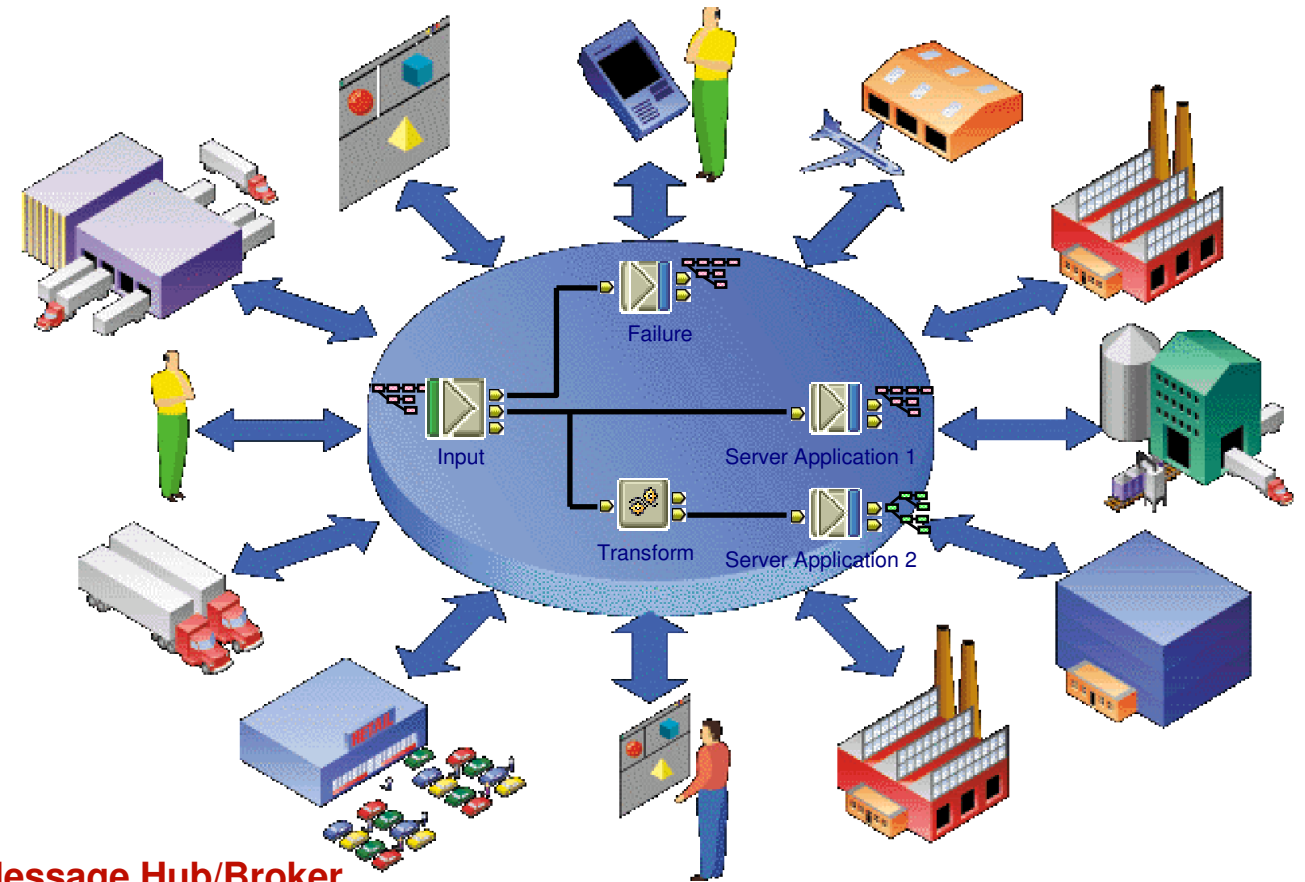
Creating an Application Integrator -With WMBv6



- Join Applications & Information sources
- Heterogeneous & decoupled
- Data validate
- Data routing
- Data transform (reshape, reformat)
- DBMS Integration
- Transactional
- Stateless

Message Hub/Broker

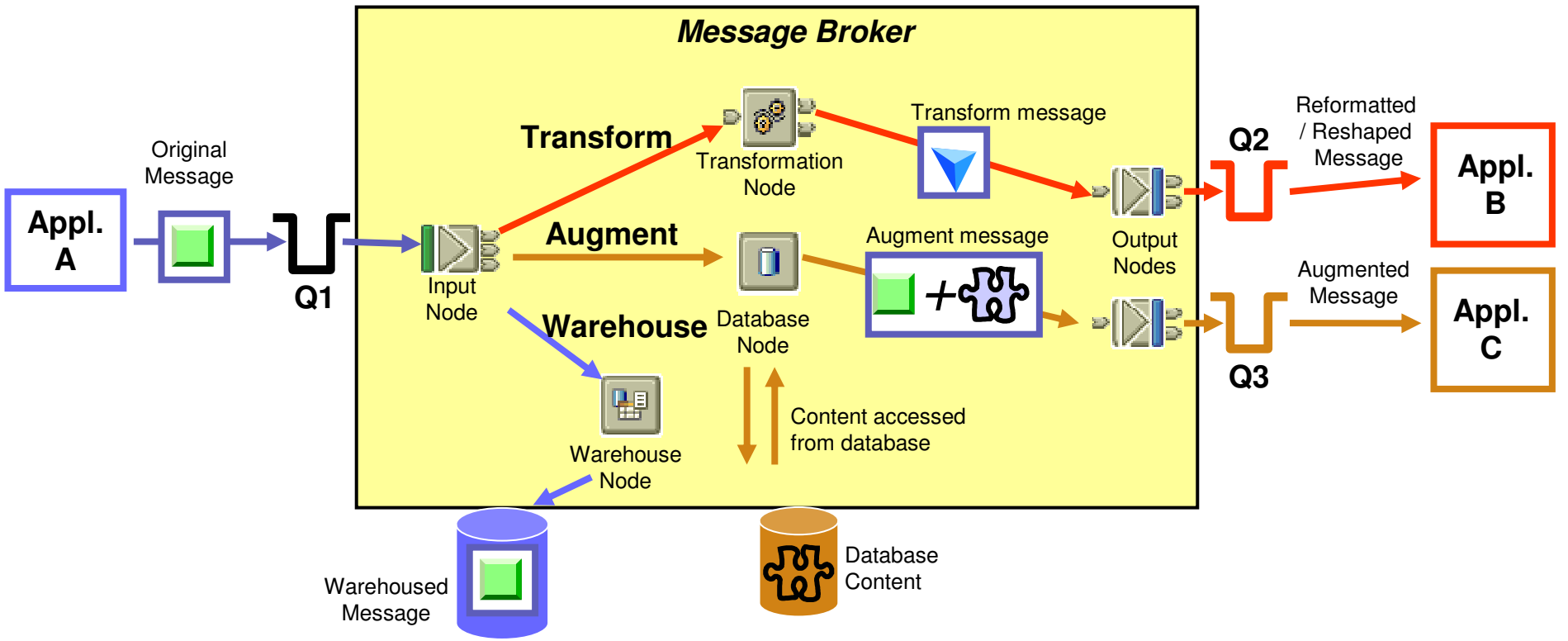
- **Transformation (Reshape, Reformat)**
- **Business Rules**
- **Intelligent Routing, Publish \ Subscribe**
- **Multiple Protocols In & Out**

- Simple
- Extensible
- Standards based

Message Broker -Transforms messages 'in flight'

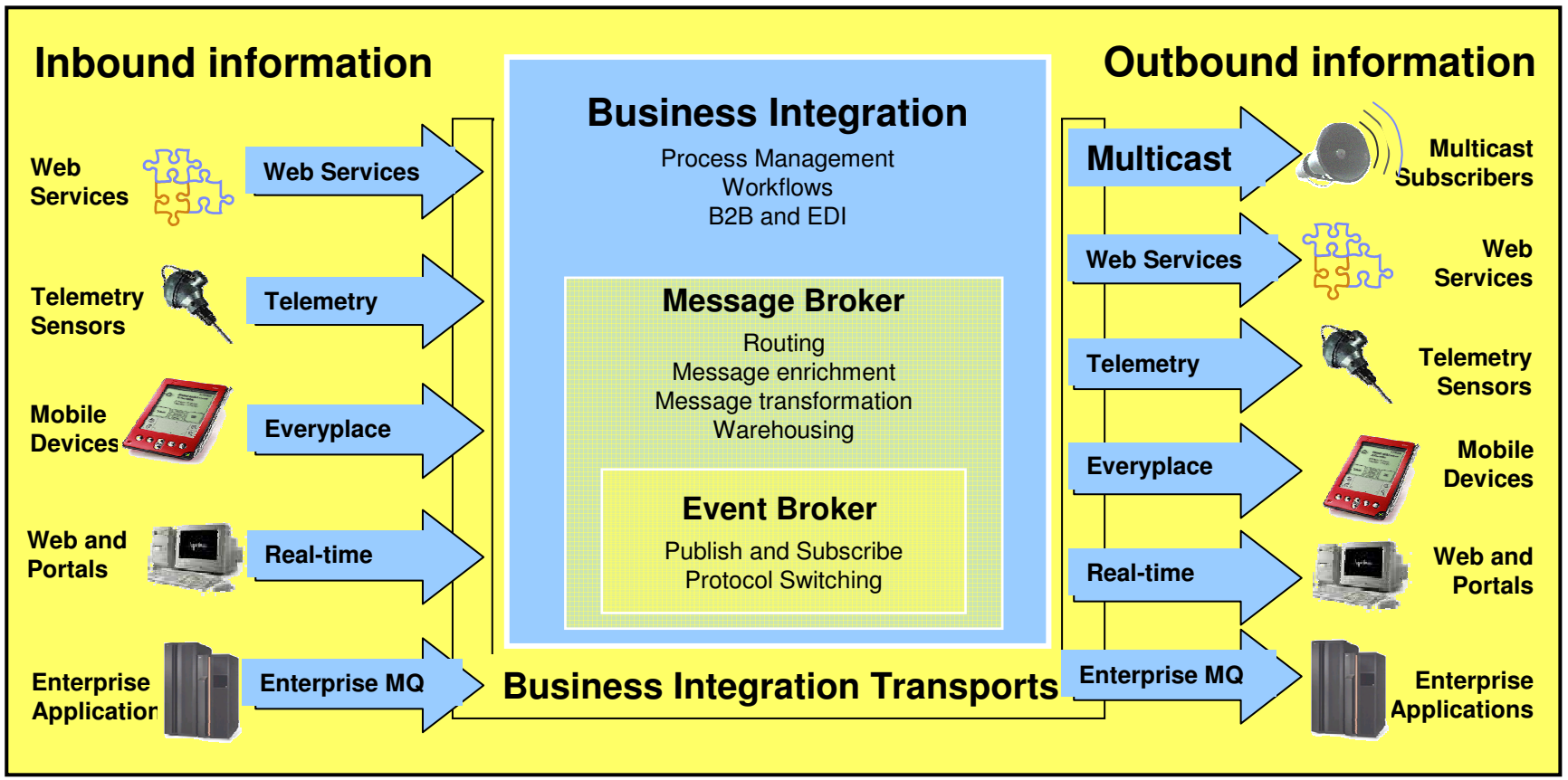
Delivers messages to the right place and in the right format.

- **Examine the content of a message**
- **Transform the content**
- **Augment the message**
- **Warehouses the message**
- **…and assure Transactional delivery!.**

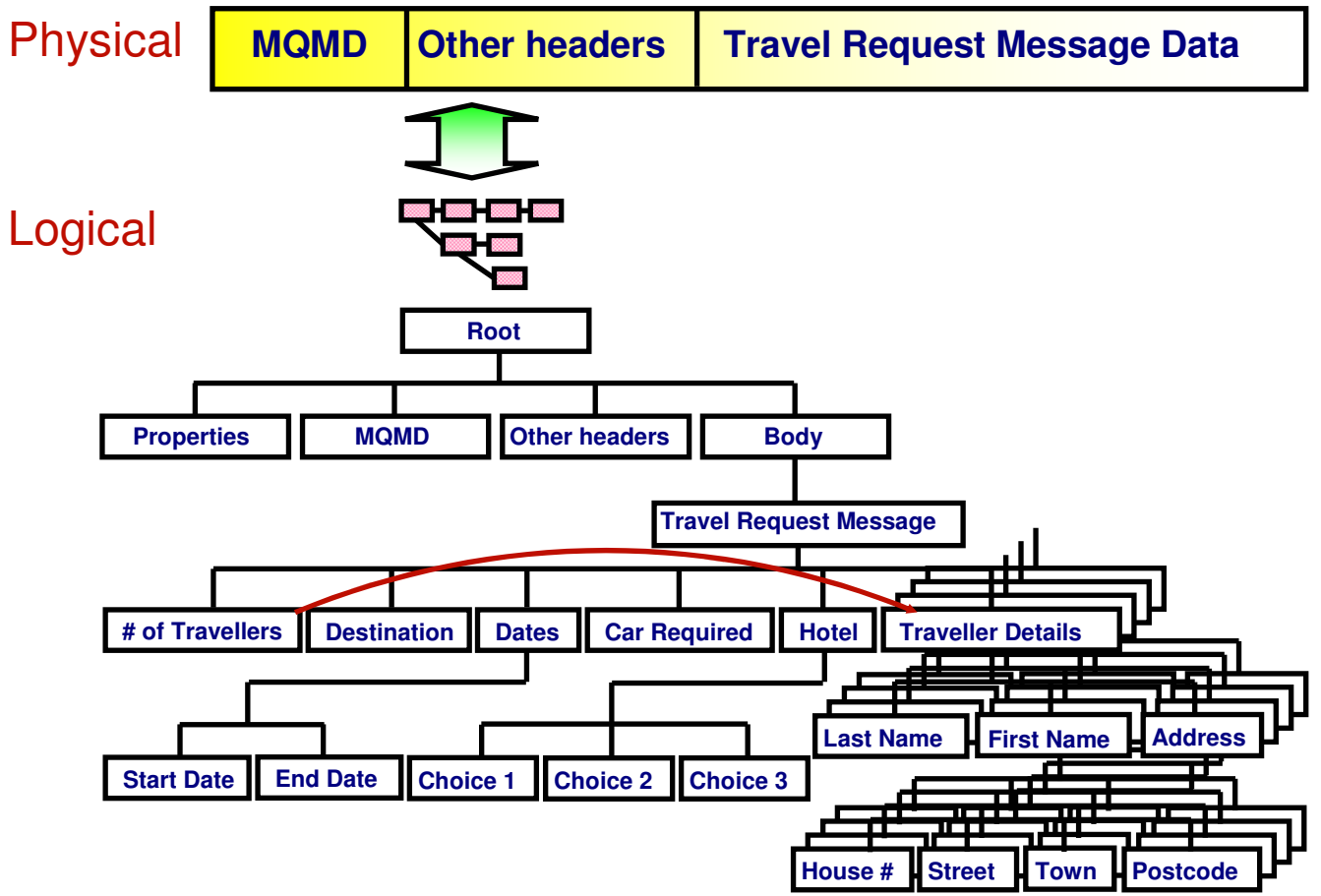


WMBv6 Business Integration Transports

The six BI Transports are optimised for different applications. They should be seamlessly interconnected to BI Message Brokers and BI Servers.



WMBv6 Message Model - Logical Messages



Root.Body.TravelRequestMessage.TravellerDetails[4].Address.House#

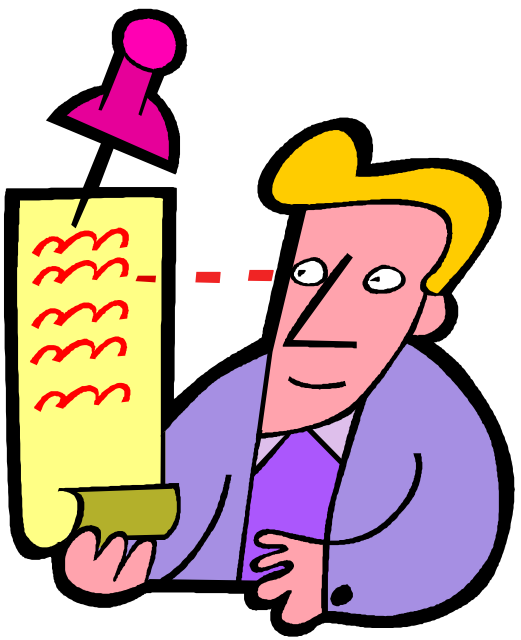
WMBv6 Message Model … Message Formats

The MRM can model most messaging formats

- XML
- Fixed length
- Delimited
- Tagged
- Industry standard formats

WMBv6 Message Modeling 1 of 2

- XML and XML Schema
  - Support more XML schema features (xsi:type, xsi:list, xsi:union)
  - New XMLSNC ‘compact tree’ parser for XML
    - Tree size reduced by up to 66%
  - New MQRFH2C ‘compact tree’ parser for RFH2
- MIME parser
  - Emphasis on multipart MIME messages
  - SOAP with Attachments
  - RossettaNet
  - TLOG
- COBOL and C
  - COBOL and C importer enhancements
  - Better support for COBOL OCCURS DEPENDING ON
  - Unbounded repetitions



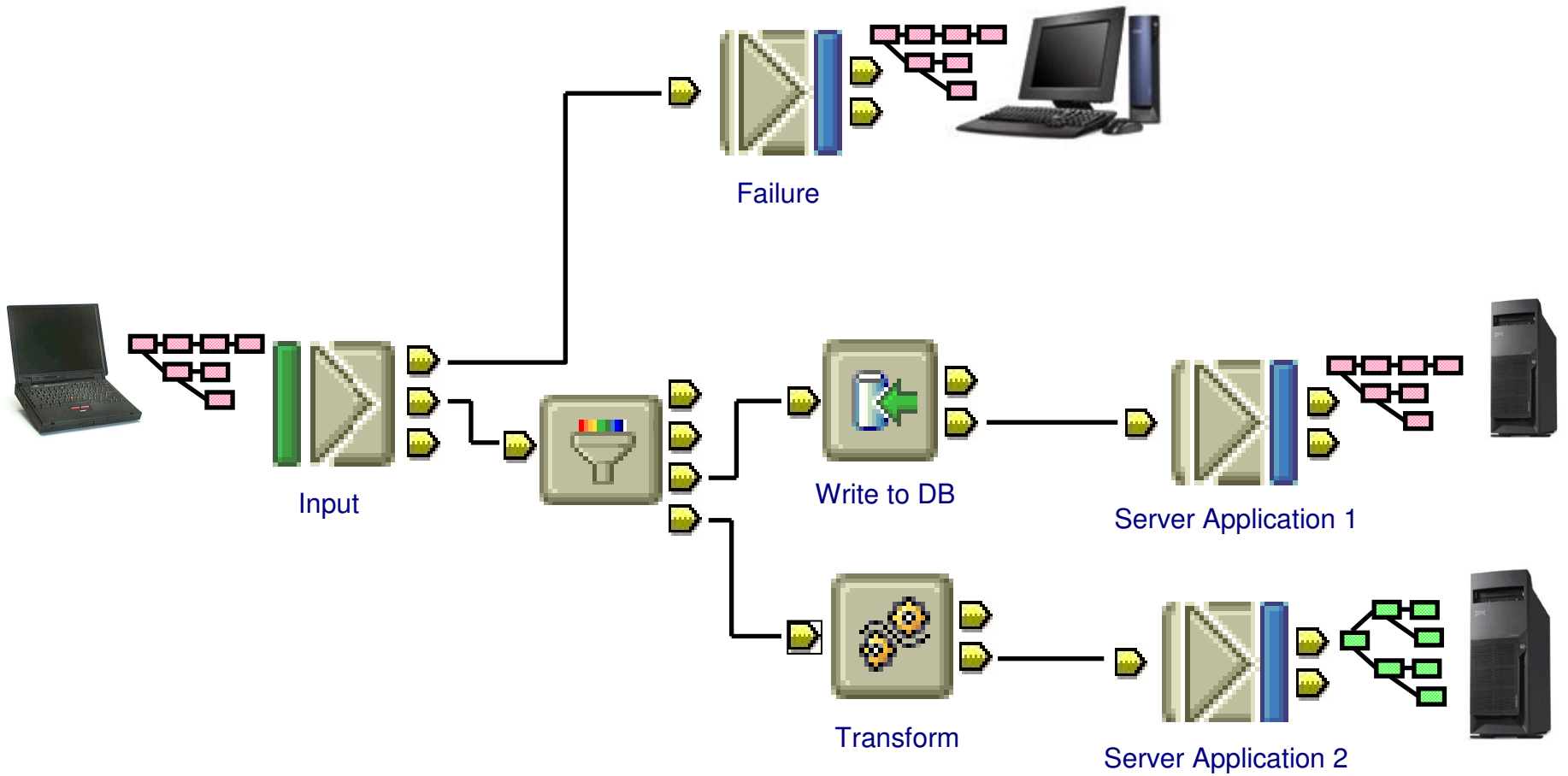
WMBv6 Message Modeling 2 of 2

- Messaging Standards
  - Better integration of SAP/IDOC parser
  - Toleration of extra white space in EDI messages
- Validation
  - New Validate node for point in time validation
  - Validation options provided on more nodes
  - New options to **ThrowException** after **all** validation failures detected
- Other Enhancements
  - Embedded messages can be defined in a separate message set
  - Ability to force a complete parse of a message
  - Unbounded repetitions for all varieties of text message
  - Pre-canned message definitions
    - SOAP enveloper/encoding, Timeout request, MIME, SAP IDoc
- Performance
  - Implementation; exploit without user changes

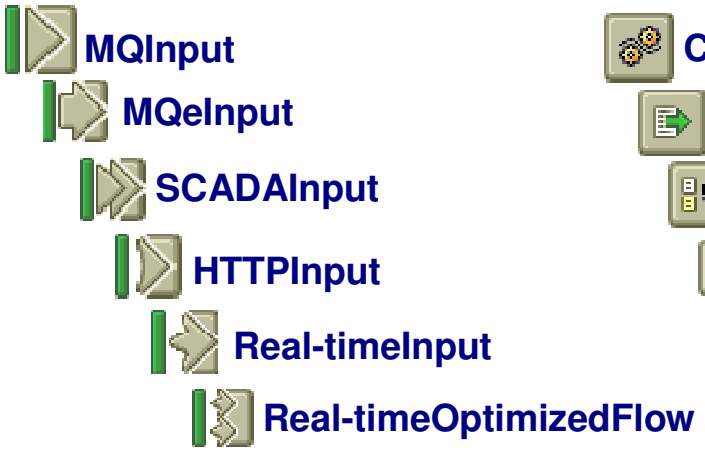
WMBv6 Web Services Support

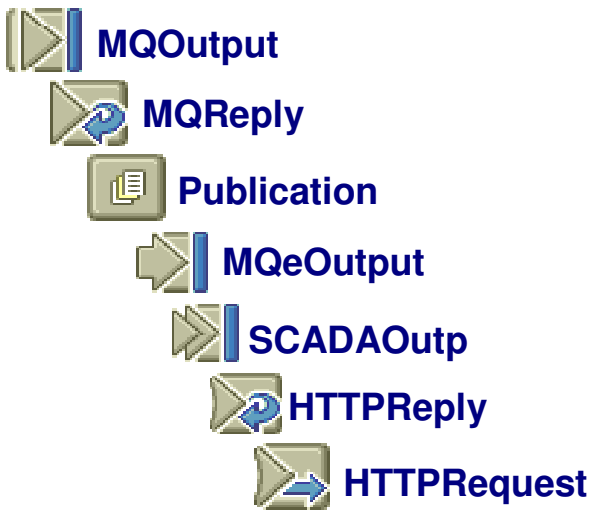
- Improved support for modelling and working with SOAP messages
  - Pre-defined message definitions for SOAP
  - Support for SOAP with Attachments via new MIME parser
- Greater flexibility in generating WSDL
  - Single/multi-file formats, rpc and document styles
- A mechanism for importing an existing WSDL definition
  - A new WSDL importer wizard, accepting a variety of WSDL styles as above
- More flexible protocol support
  - Support for SOAP 1.1 and SOAP 1.2, and for HTTP 1.1, HTTPS
- Built-in WS-I Compliance checking
  - Automatically validates WSDL against the WS-I Basic Profile

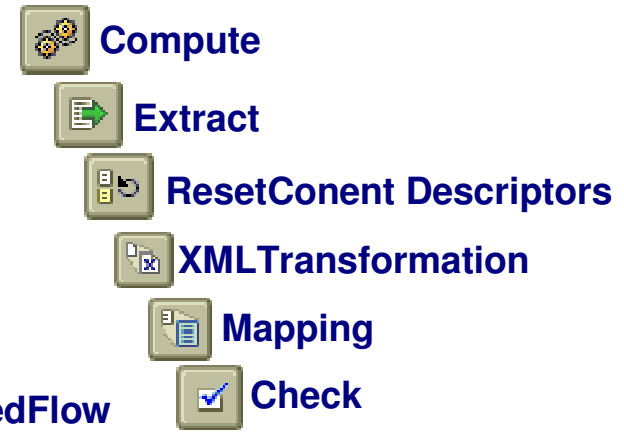
WMBv6 Message Flows

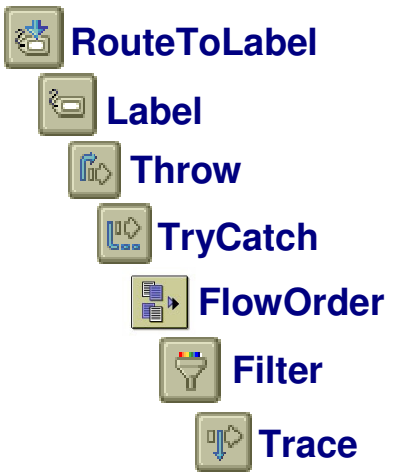


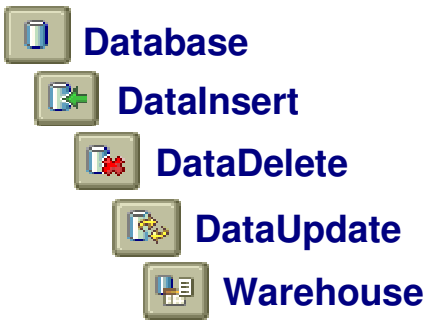
WMBv6 Message Processing Nodes

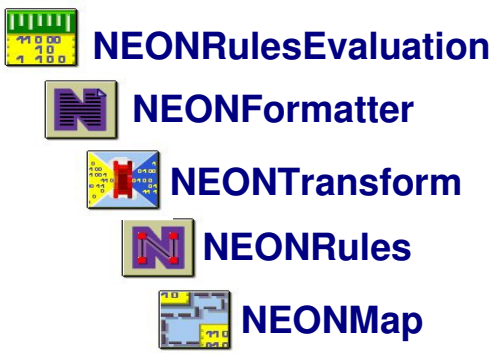












WMBv6 Messaging Processing Nodes: New & Updated

New

- Java Compute node
  - Provide existing Compute node capability for Java programmers
  - Deploy Java JARs
- TimerControl Node
  - One shot, Periodic, N shot (persistent and non persistent)
- MQGET node
  - Support for SOAP/JMS (MQ)
  - Simple aggregation and/or mechanism to hold state
- JMS Input/Output
  - Native JMS Interoperability

Now Available

- DataStage TX node
  - Run existing DSTX/Mercator maps unchanged
  - Leverage extended capabilities
- File node
  - ability to process data held in files

Updated

- Web Services
  - HTTPS support
- Aggregation
  - MQ based implementation
  - Delivers improved performance
- XSLT
  - Deployed style sheets
  - Compiled style sheets
- Publication
  - Support for Multicast PGM

WMBv6 Message Model & ESQL Processing

DataInsert

```
IF Body.Person.height > 183 THEN

 INSERT INTO Database.TallPeople
        (Name,Height,Age)
 VALUES (Body.Person.Name,
         Body.Person.height,
         Body.Person.age);
ENDIF;
```

Compute

```
IF (XML format required) THEN
 OutputRoot.Properties.MessageFormat = 'XML';
ELSE IF (custom format)
 OutputRoot.Properties.MessageFormat = 'CWF';
ELSE IF (SWIFT format)
 OutputRoot.Properties.MessageFormat = 'TDS';
ENDIF;
```

Data types
- INTEGER
- FLOAT
- DECIMAL
- STRING
- DATETIME
- BOOLEAN
- REFERENCE
- NULL
- ...

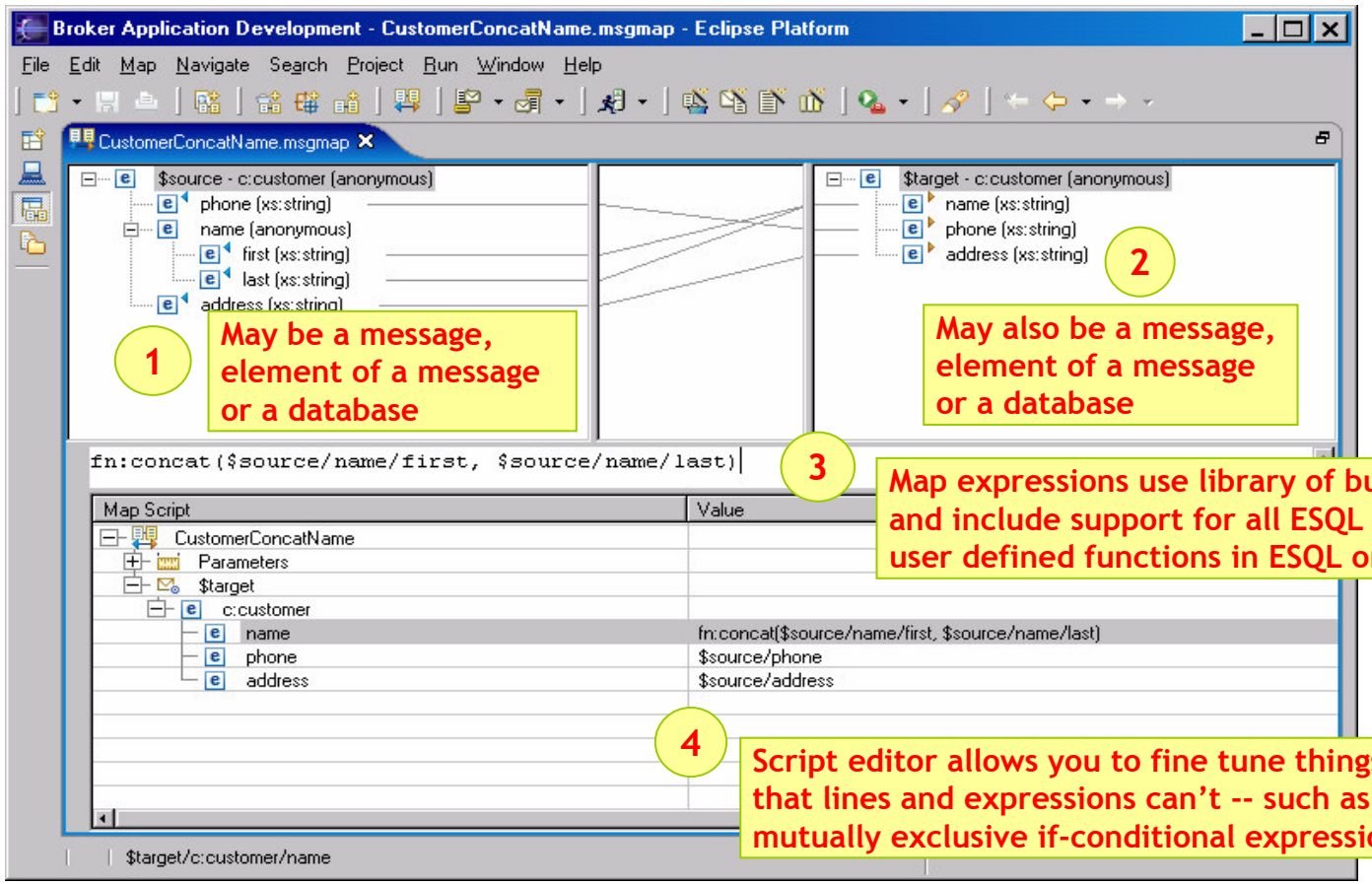
Operators
- - + * /
- ||
- AND OR NOT
- = <> > >= < <=
- IN BETWEEN
- LIKE
- IS EXISTS
- ...

Statements
- Basic
  - DECLARE
  - SET
  - IF ENDIF
  - WHILE
- Tree
  - MOVE
  - CREATE
  - DETACH
  - ATTACH
- Database
  - INSERT
  - DELETE
  - UPDATE
  - PASSTHRU
  - EVAL
- Node
  - PROPAGATE
  - RETURN
  - THROW
  - ...

Functions
- String
  - LENGTH
  - TRIM LTRIM RTRIM
  - OVERLAY
  - POSITION
  - SUBSTRING
  - UCASE LCASE
- Numeric
  - ABS
  - BITAND NOT (X)OR
  - MOD ROUND
  - SQRT
  - TRUNCATE
- Datetime
  - EXTRACT
  - CURRENTDATE
  - CURRENTTIME
- Field
- CARDINALITY
  - FIELDTYPE
  - SAMEFIELD
- Complex
  - CAST
  - SELECT
  - ...

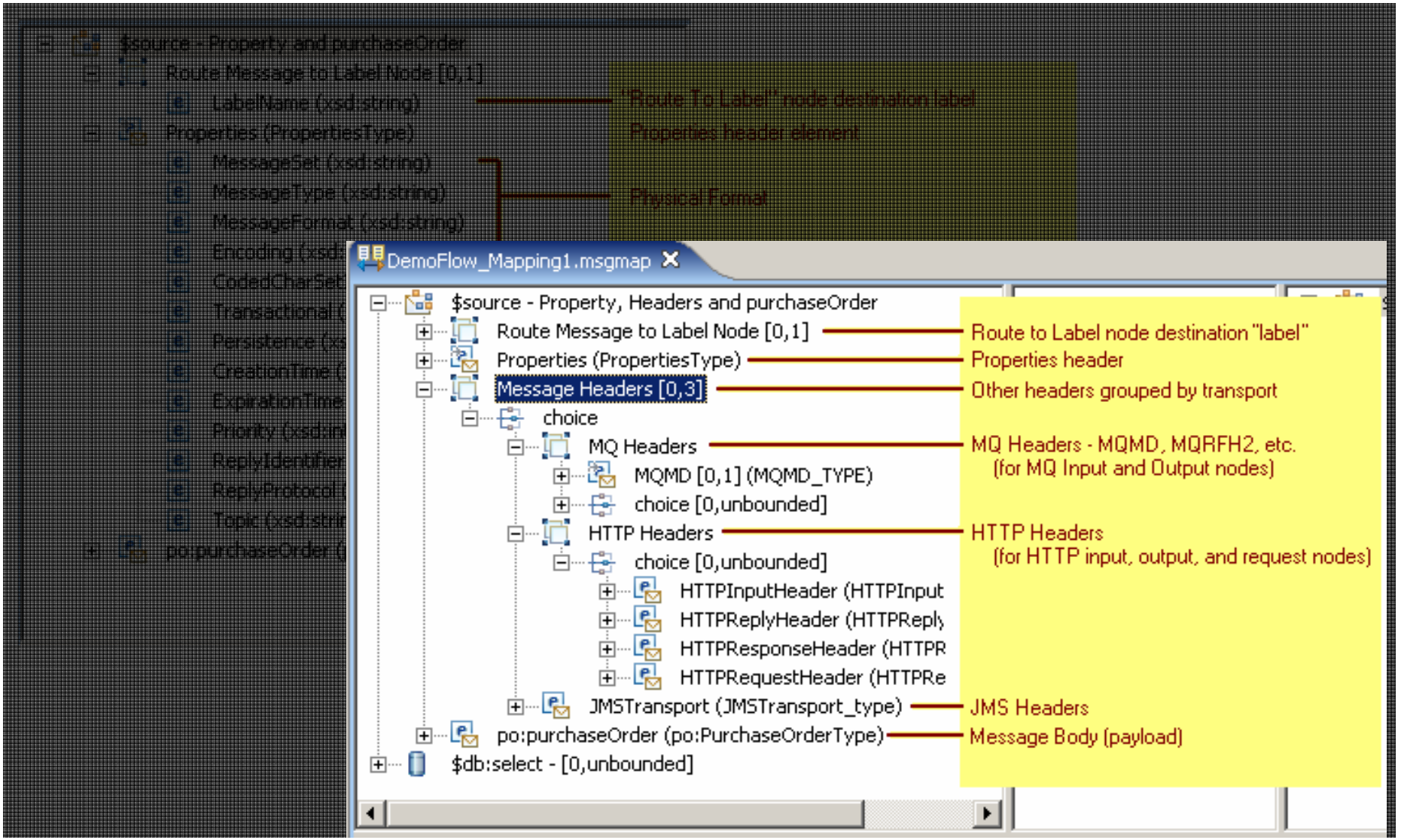
WMBv6 'next generation' mapping editor

- Adopt a spreadsheet model for creating transformations …
  … the user concentrates on the structural transformations not the execution logic



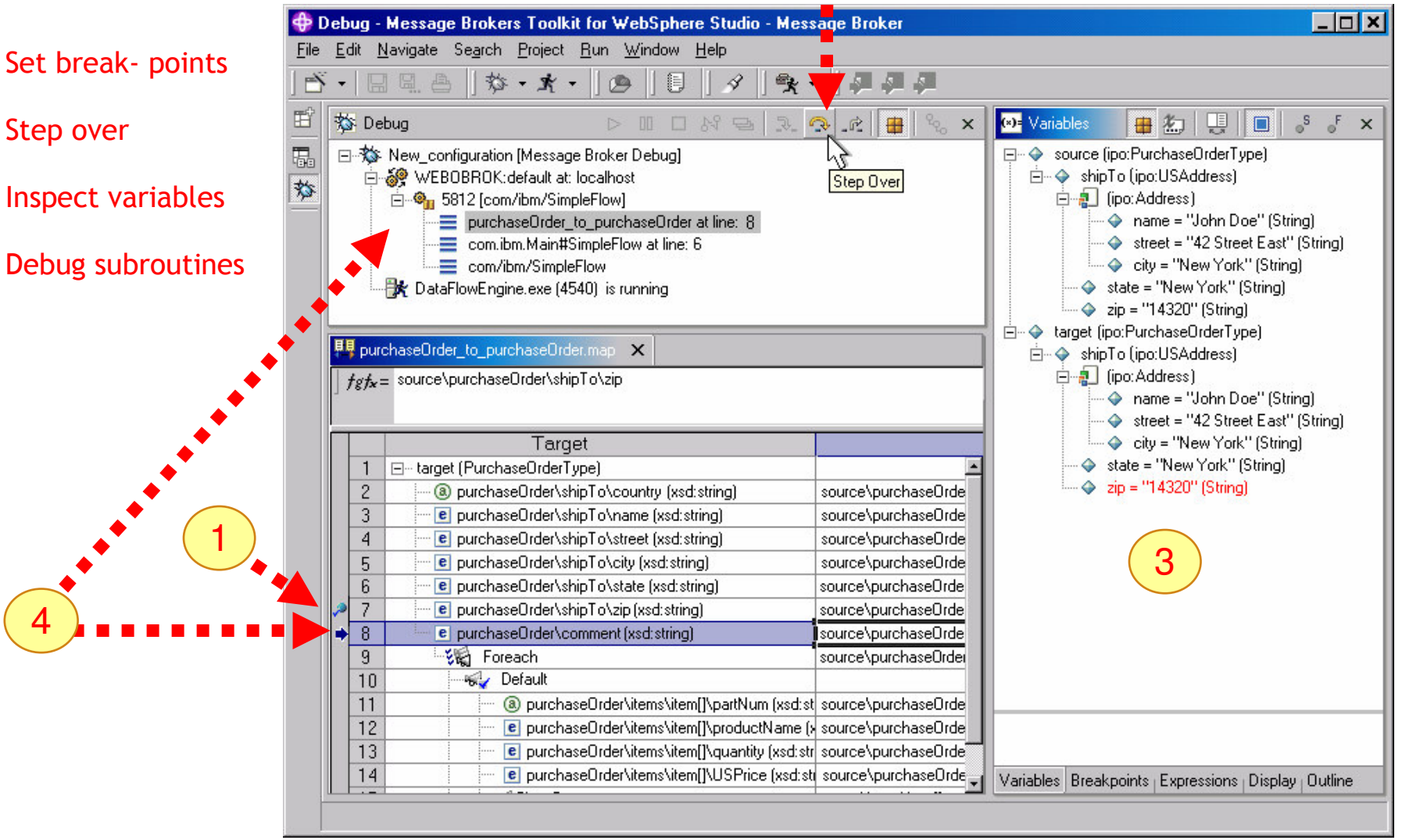
1. Source definition
2. Target definition
3. Expression editor
4. Overview and editor

Map 'Properties and Message' or 'Properties, Headers and Message'



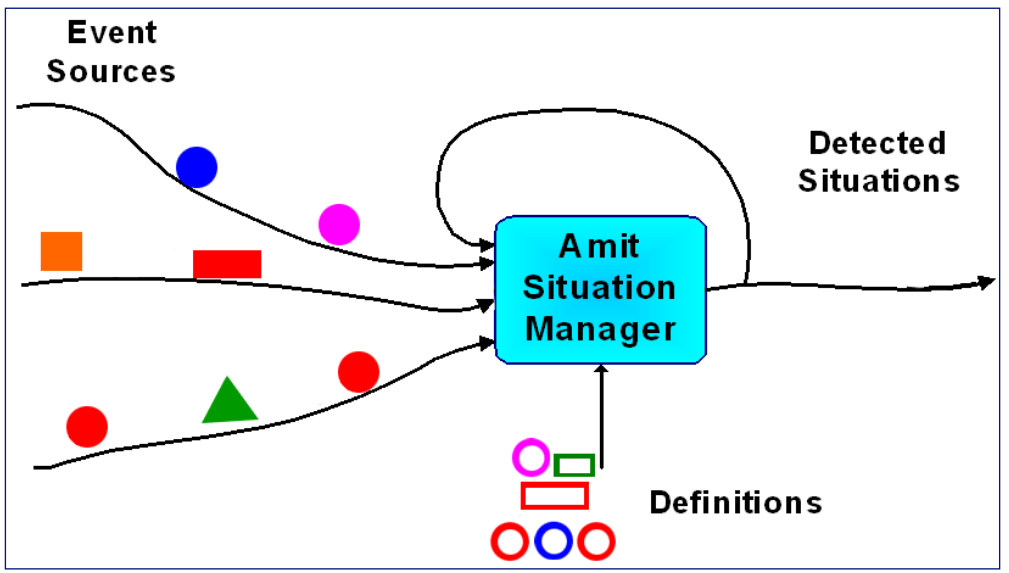
WMBv6 Mapping editor: debug vi

1. Set break- points
2. Step over
3. Inspect variables
4. Debug subroutines



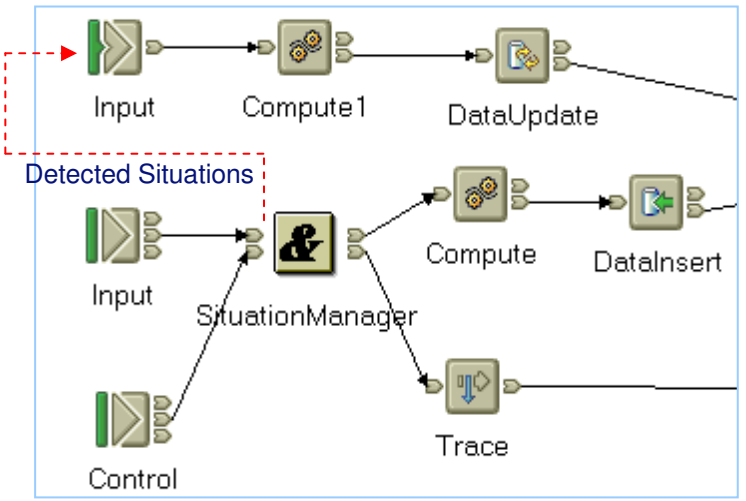
WMBv6 Event Correlation Services

- Active Systems are systems that contain active (event-driven) components
  - Reactive Systems – React to something that happens in the system (server failed, direct requests to other servers)
  - Proactive Systems – Use predictive methods to redirect towards better results and or eliminate problems (server utilization is high, direct request to other servers)
- Processing of action triggered not by a single event, but by a complex composition of events, happening at different times, and within different contexts
- Examples: compliance checks, fraud detection, monitoring of service level agreements, etc



WMBv6 Complex Event Processing

- Processing of action triggered not by a single event, but by a complex composition of events, happening at different times, and within different contexts
- Examples: compliance checks, fraud detection, monitoring SLAs, etc.

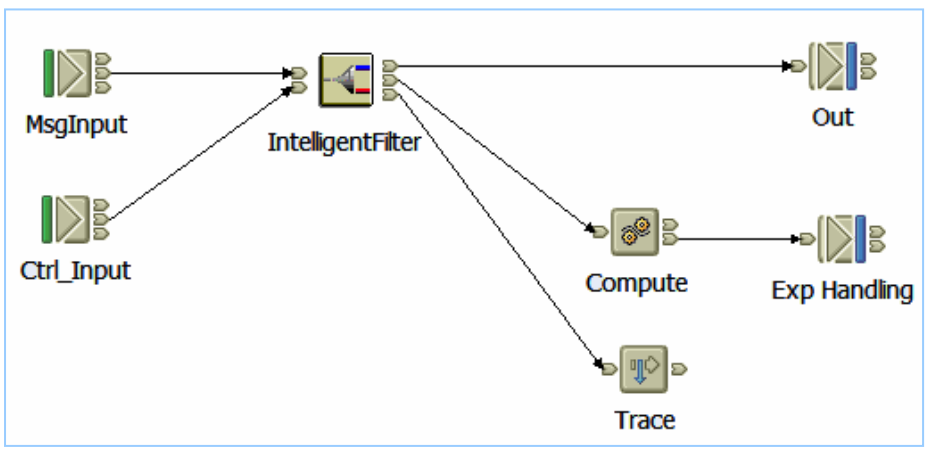


SituationManager Node

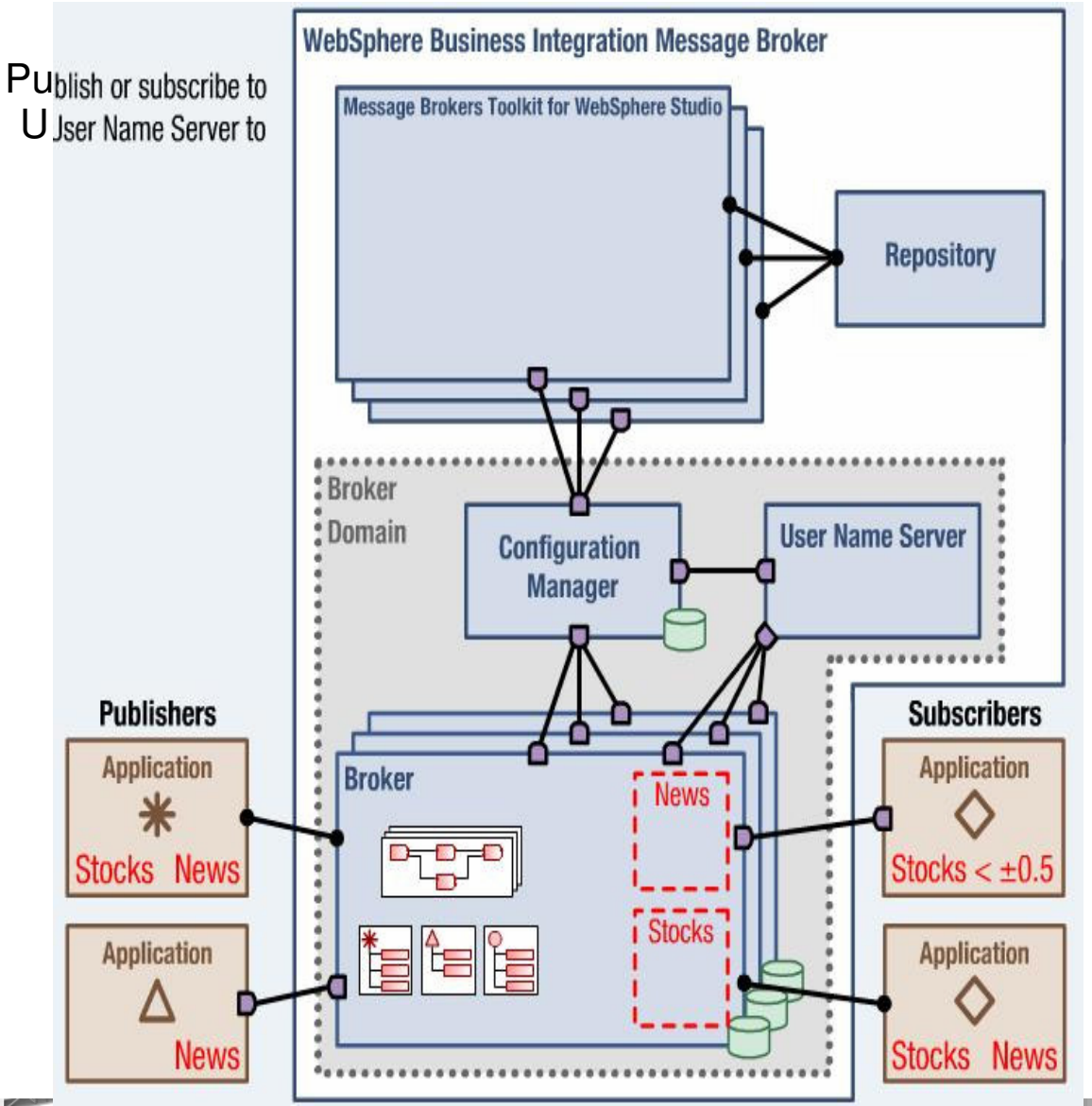
- Detected situations result in message being written to queue

IntelligentFilter Node

- Detected situations result in alternate path through messageflow

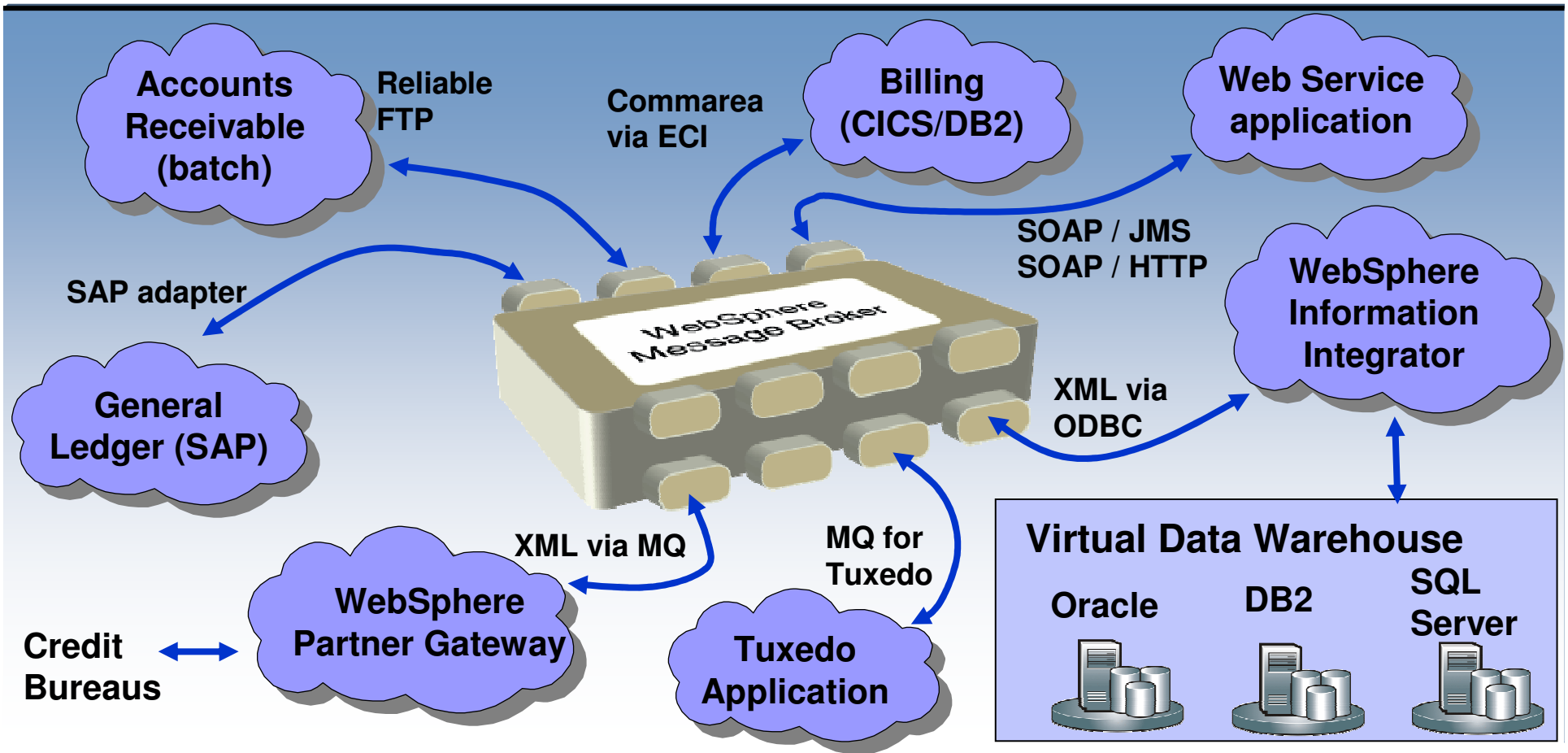


WMBv6 Architecture



Scenario 2: WebSphere Message Broker

Challenge: JK Enterprises is looking to improve sales and customer service to better align with business. This is a complex, highly heterogeneous environment – Web Services **and** non Web Services communication required. Furthermore, JK needs to correlate individual messages as they cross the ESB to detect fraudulent situations



Scenario 3: WebSphere ESB and WebSphere Message Broker

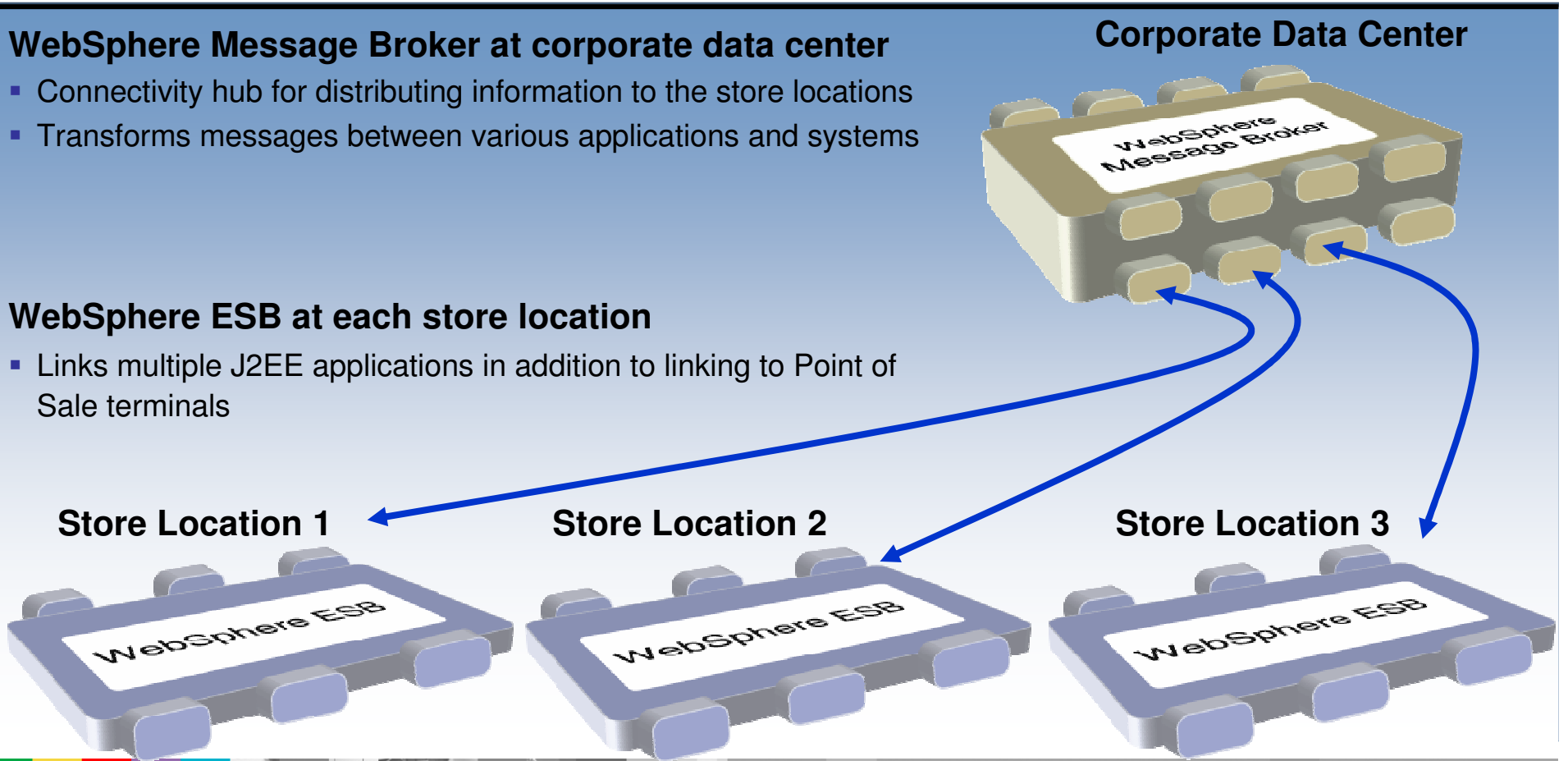
Challenge: Retail Stores, Inc. faced three integration headaches: Integration efforts at the corporate data center were brittle, a new store system scheduled for introduction required integration to occur at the store level, and each of the over 500 store locations had to be seamlessly linked to the corporate data center.

WebSphere Message Broker at corporate data center

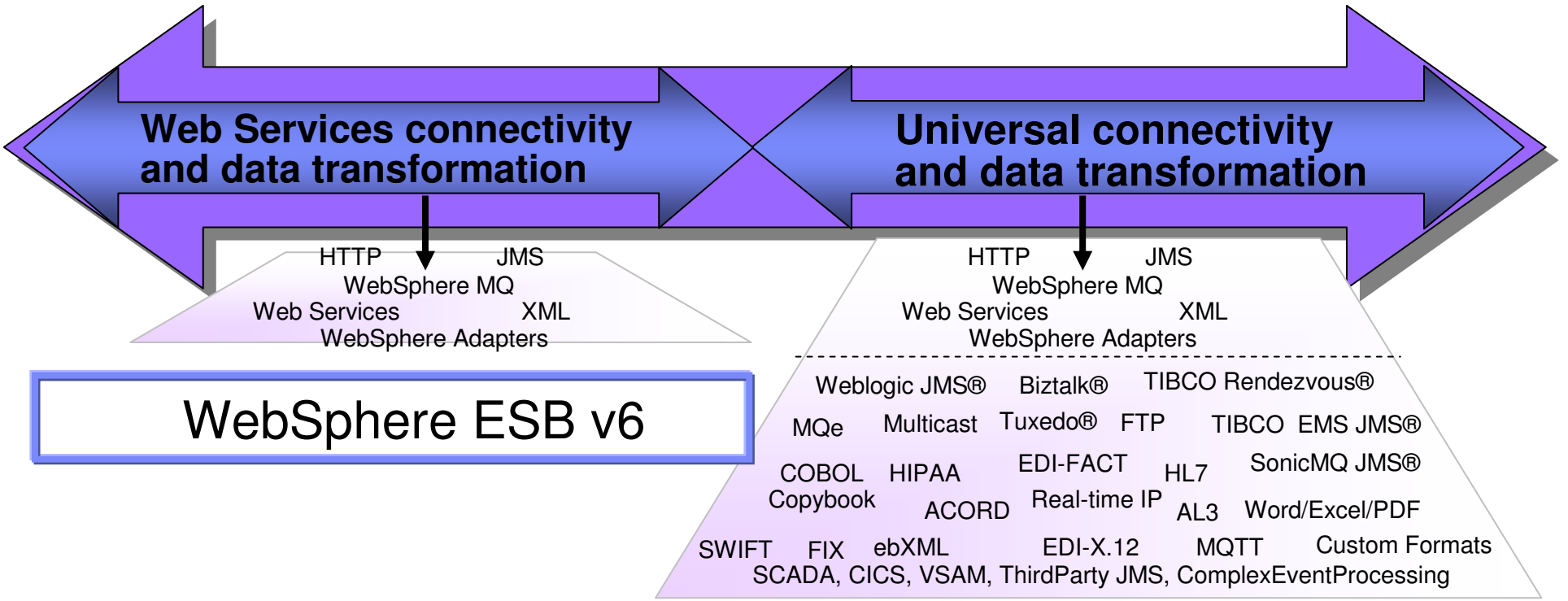
- Connectivity hub for distributing information to the store locations
- Transforms messages between various applications and systems

WebSphere ESB at each store location

- Links multiple J2EE applications in addition to linking to Point of Sale terminals



ESB for "Advanced ESB" Mediation (WebSphere Message Broker)



Customers face a range of basic and advanced ESB requirements. Any given project might require a combination.

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Enterprise Service Bus Overview

IBM WebSphere Software Platform for Integration

Adapter Concepts

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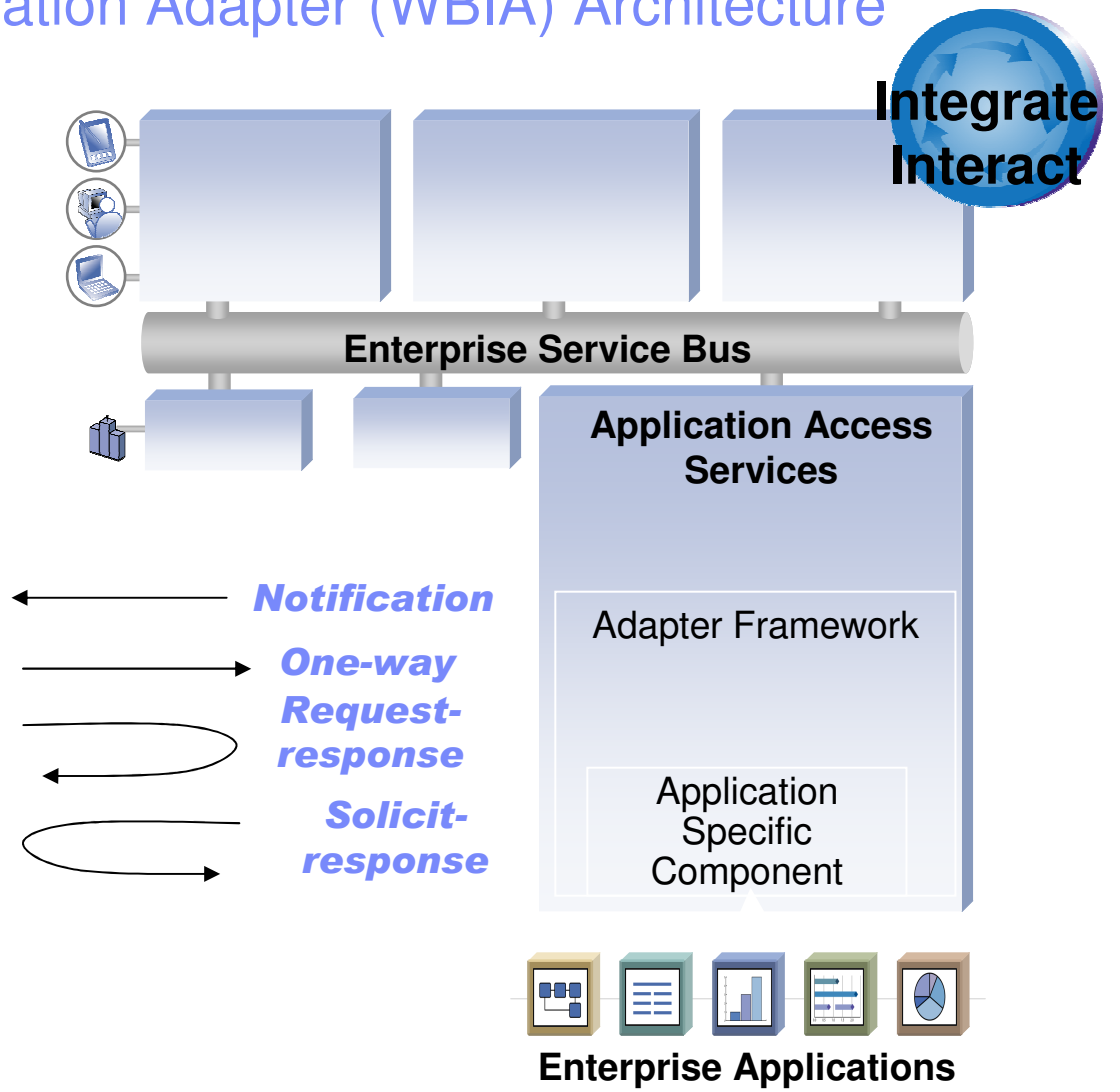
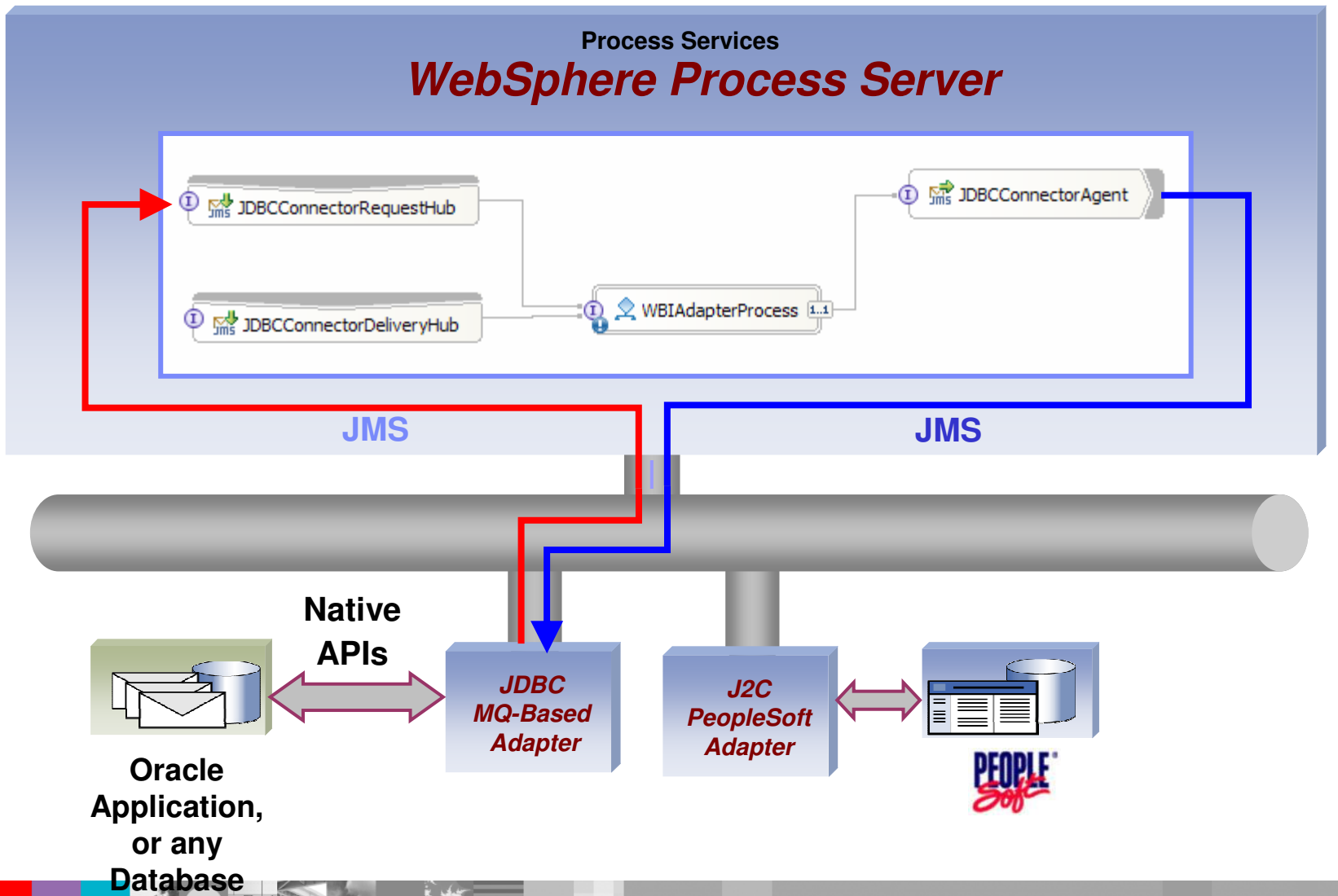
WebSphere Business Integration Adapter (WBIA) Architecture

- WBIA Works with WPS, WAS, WMB,..
- Works with new \ existing Application Packages (eg PeopleSoft) and APIs (eg JDBC)
- Based on a standard framework
- Fast and flexible configuration
- Adapt almost any app or database
- Communicates with multiple transports (JMS, MQ, IIOP)
- Process multiple interactions in parallel
- Senses and reacts to application events
- Object Discovery Agent to “Auto-discover” your endpoint interfaces and business objects



JMS Based Adapters - Architecture



WebSphere Business Integration Adapters are JMS Based

Application Adapters

- Ariba Buyer
- Clarify CRM
- eMatrix
- i2
- i2 Active Data Warehouse
- IndusConnect Framework
- Maximo MEA
- MetaSolv Applications
- mySAP.com
- NightFire Applications
- Oracle Applications
- PeopleSoft
- Portal Infranet
- QAD MFG/PRO
- Retek
- Siebel eBusiness Applications
- Spirent Applications
- Telcordia Applications
- WebSphere Commerce

Technology Adapters

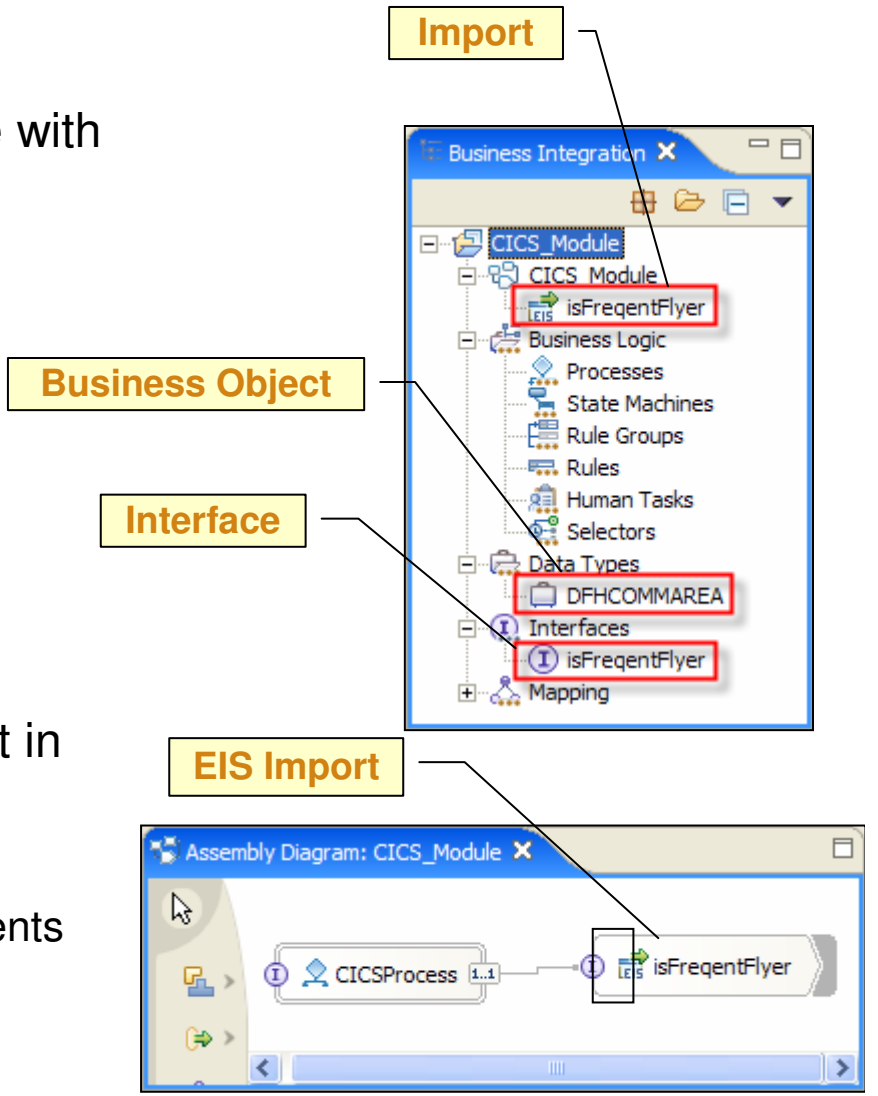
- Adapter for e-mail
- FIX Protocol
- JMS
- Jtext (FlatFile)
- JDBC
- MQ
- MQ Integrator
- MQ Workflow
- SWIFT
- XML
- Data Handler for XML
- Data Handler for EDI
- Web Services

Mainframe Adapters

- ADABAS
- CICS
- DB2 Databases
- IMS Transaction Manager
- IMS Database Manager
- VSAM
- Natural
- IDMS Database

WebSphere Adapters are JCA Based

- Provides Service Oriented Approach to EIS integration
- Adapters allow components to communicate with the EIS systems using consistent SCA programming model
  - Interfaces - EIS functions and events
  - Business Objects - EIS data
  - EIS Import - Outbound
  - EIS Export - Inbound
- There two type of WebSphere Adapters
  - Support JCA and JMS
- Enterprise Metadata Discovery EMD support in WID tools provides simple and easy way to generate SCA based artifacts
  - Enable to access EIS systems from Components
  - “Auto-discover” your endpoint interfaces and business objects !

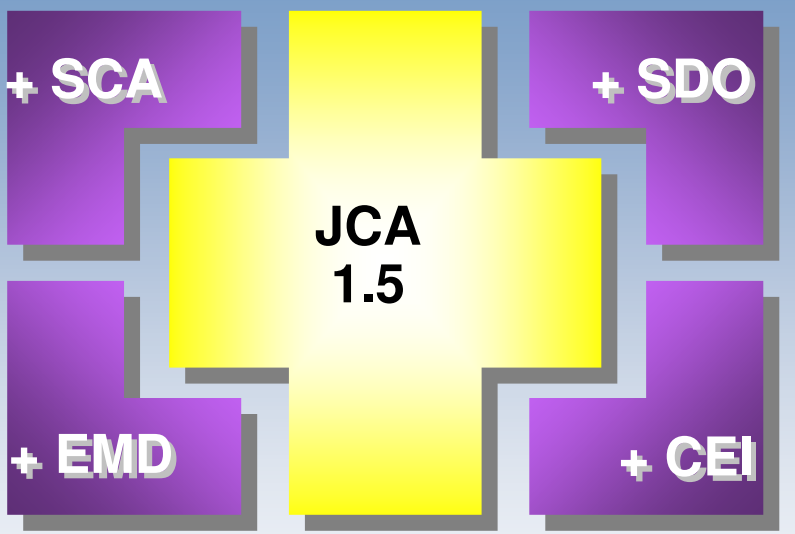


Significance of WebSphere JCA Adapters (JCA)

- ***JCA 1.5 Compliant***

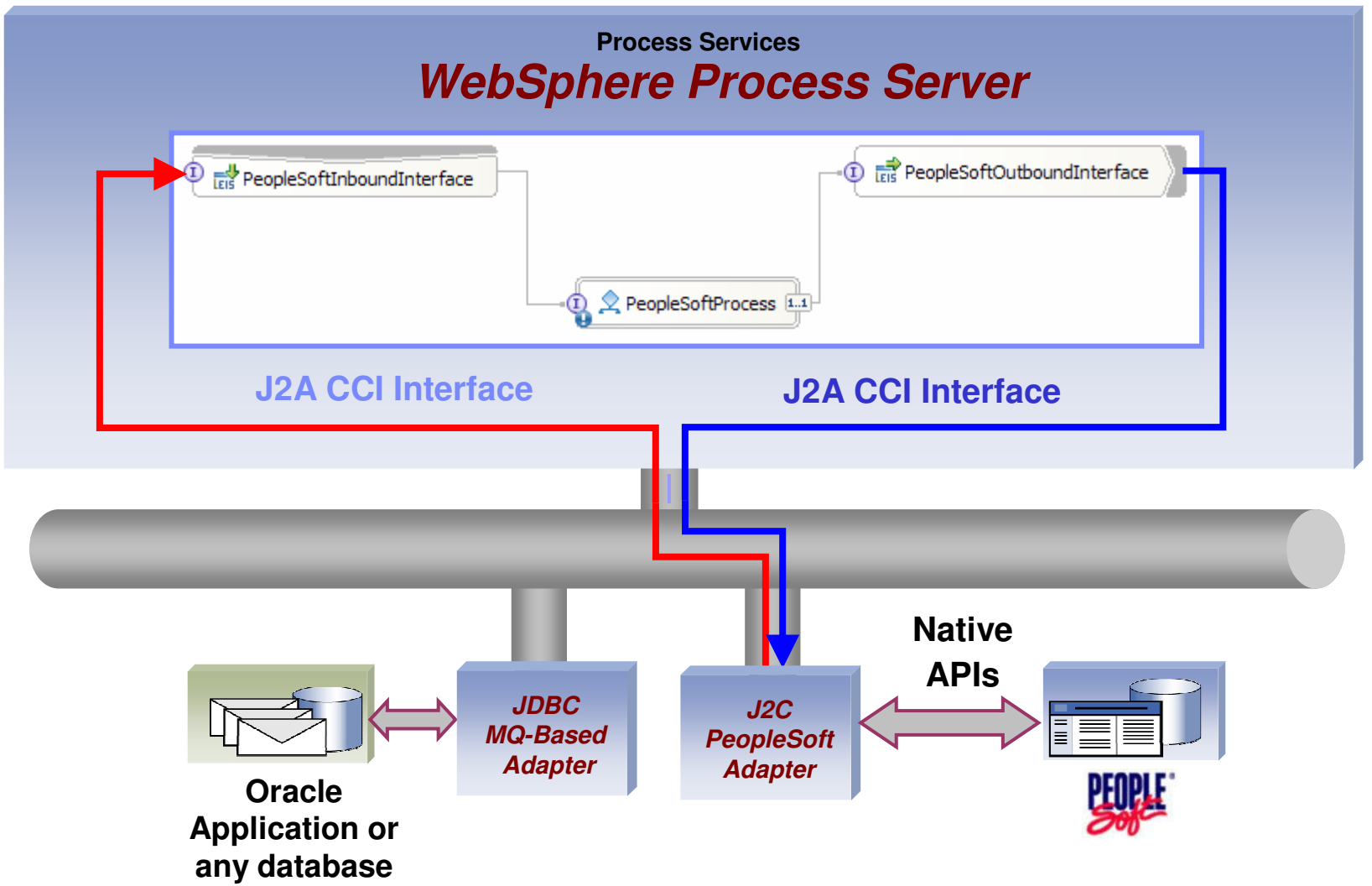
  Qualities of Service

  - Transaction Management
    - Assured Event Delivery
  - Connection Management
    - Provides scalability
  - Security Management
    - End-to-End J2EE Security



+ WebSphere Extensions

J2C Based Adapters - Architecture



WebSphere Adapters v6 are JCA\J2C Based

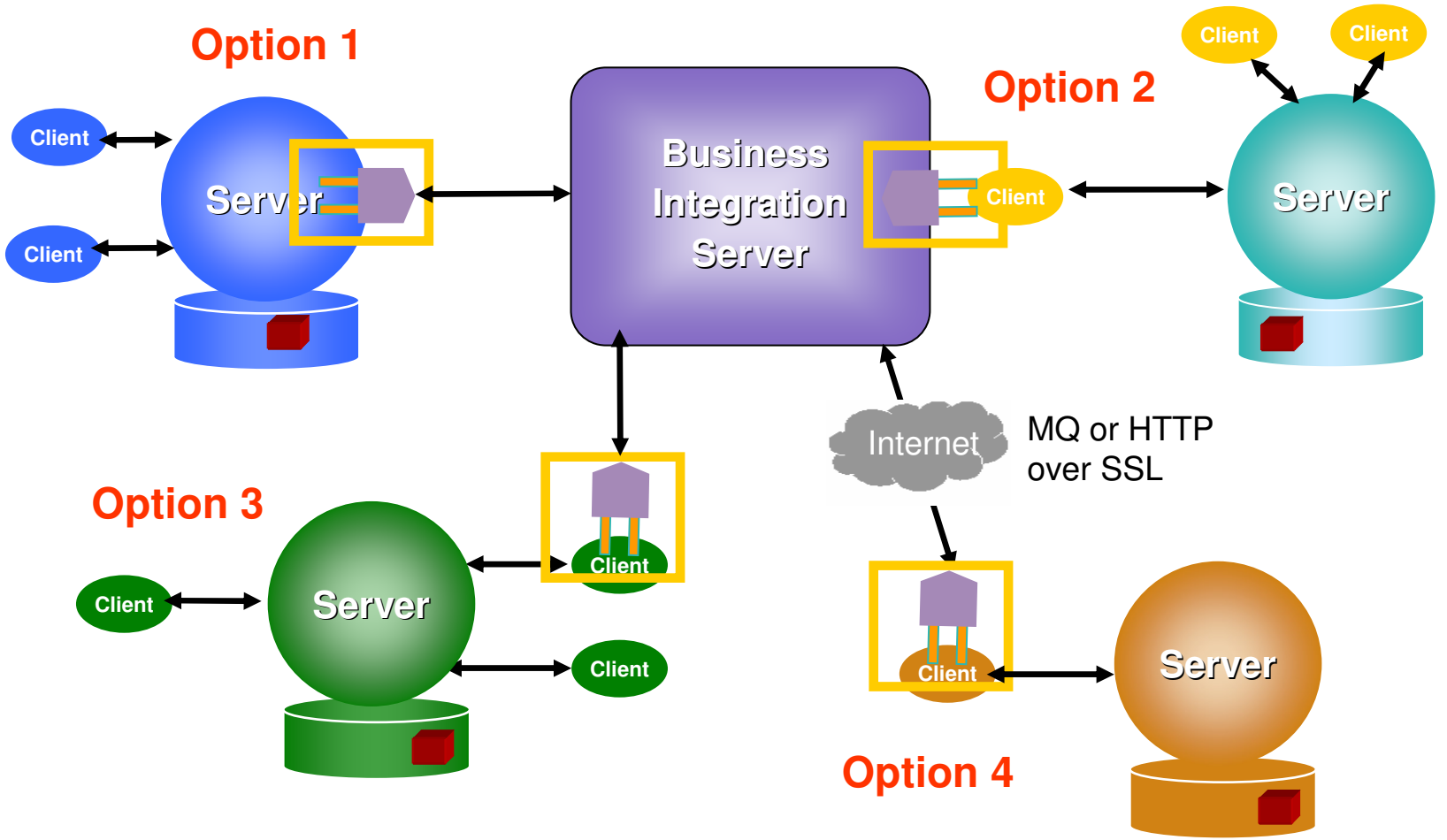
New IBM WebSphere Adapters ported from WBIA Adapters v2.x

- Flat Files v6.0
- JDBC v6.0
- PeopleSoft Enterprise v6.0
- Siebel Business Applications v6.0
- SAP Applications v6.0

WBI-SF 5.1 Adapters ported to WPSv6 & JCA 1.5

- CICS ECI 1.0
- CICS ECI 1.5
- IMS 1.0
- IMS 1.5

WBI Adapter Deployment Options – Network Topology



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DataStage TX Concepts

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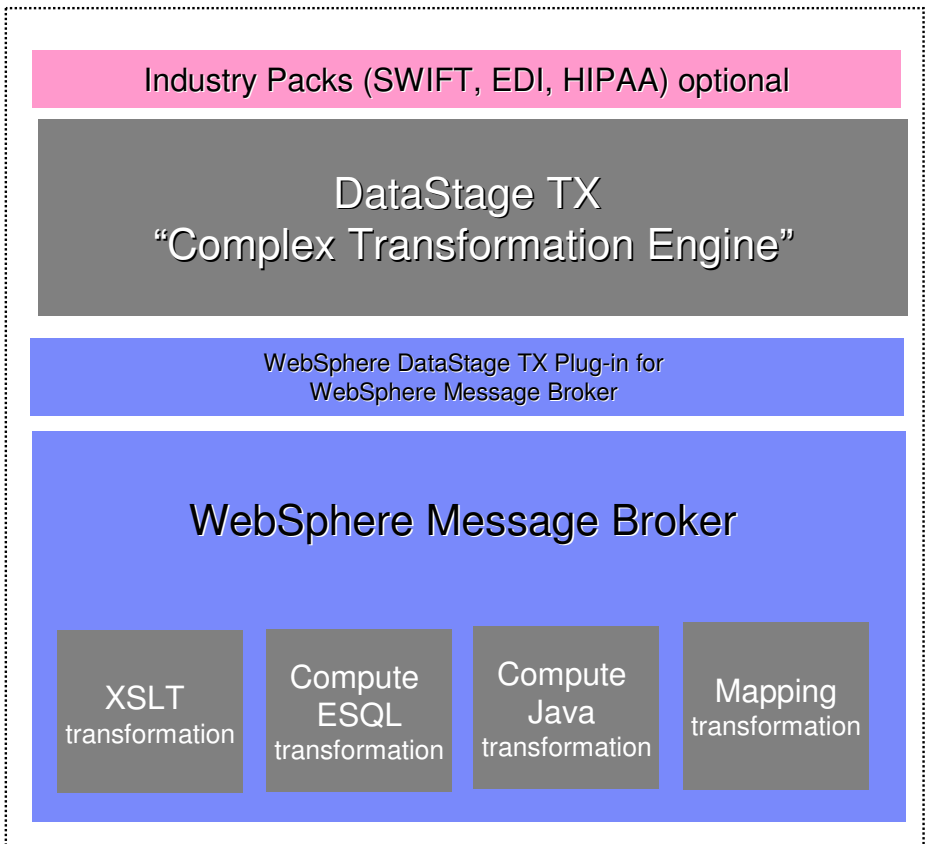
WebSphere Datastage TX node for WebSphere Message Broker

- Integration to Advanced ESB for existing Datastage TX Customers
- Additional Industry Data Solutions for Advanced ESB

Complex, Hierarchical Data Transformation and additional support for industry standards

+

Powerful Enterprise Services Bus Solution



The Most Powerful Any-to-Any Integration Broker in the Market

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IBM WebSphere Software Platform for Integration

DataPower Appliance

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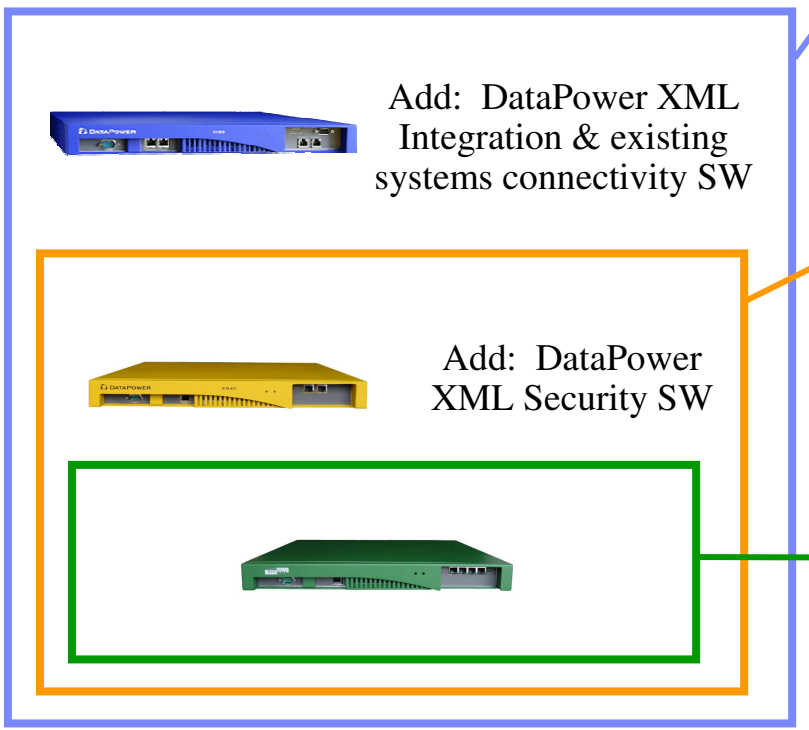
DataPower Product Packaging

DataPower products offer customers significant performance, ease of use, and packaging advantages for managing rapidly growing XML-based data



- **XI50 Integration Appliance**
  - Expands support to non-XML solutions
  - Advanced architecture
  - Integrated message-level security

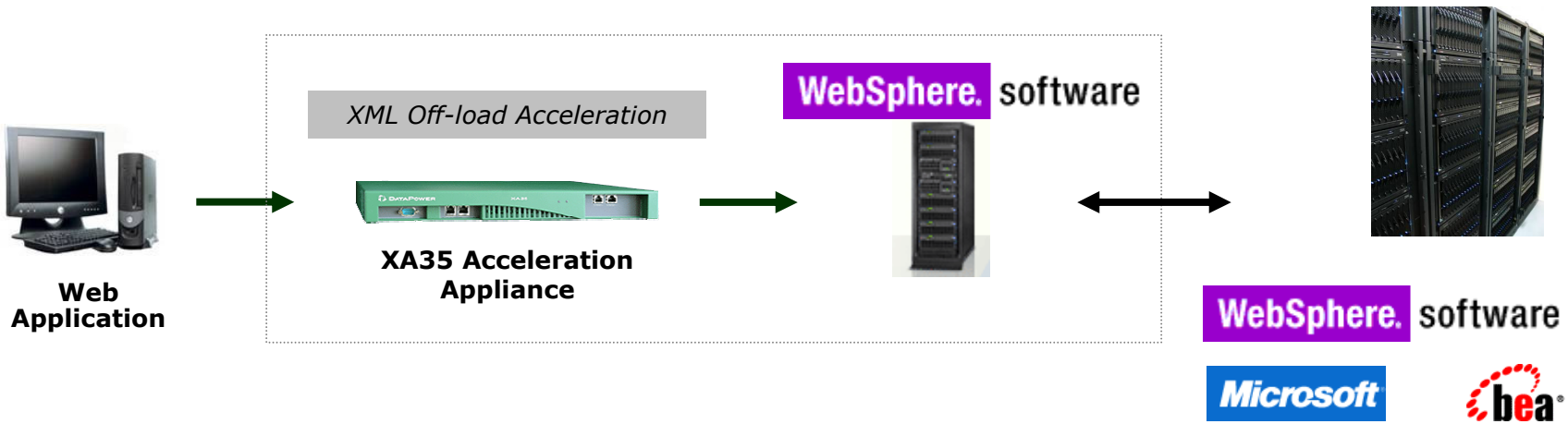
- **XS40 XML Security Gateway**
  - Security, agility and performance
  - Device can off-load application security software
  - Performs XML Web services security functions (parse, filter, validate schema, encrypt/decrypt, signatures, access control, and more)

- **XA35 XML Accelerator**
  - Offloads overtaxed servers by processing XML, XSD, XPath and XSLT at wire speed
  - SW provides significant performance improvements over WebSphere solutions
  - HW + SW provides enterprise-class performance

IBM Customers that Need to **Accelerate** Application and SOA Performance

Case in point:

Handle significant server workload generated by XML-based processing



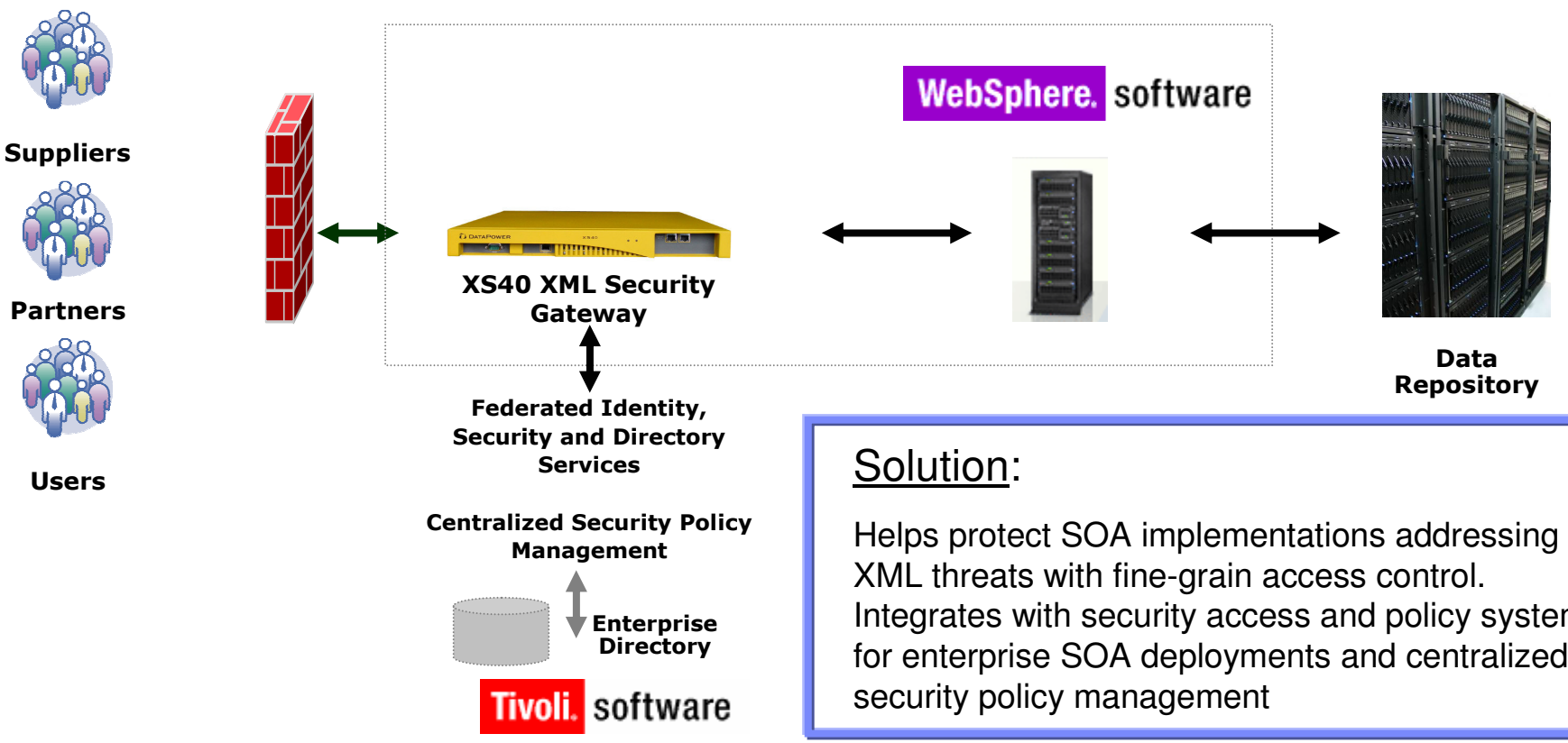
Solution:

Accelerates infrastructure implementation, offloading XML traffic to speed up processing with minimum network disruption

2 IBM Customers to **Help Protect** their SOA and IT Assets

Case in point:

First line of defense to securely implement external web services. Secure once for many applications and aggregate user interactions.



Solution:

Helps protect SOA implementations addressing XML threats with fine-grain access control. Integrates with security access and policy systems for enterprise SOA deployments and centralized security policy management

3 IBM Customers looking to **Simplify** SOA Deployment

Case in point:

Handle growing complexity demands for integrating services across multiple applications, inside and outside the enterprise

Existing Application Requests

XML message handling & security

XI50 Integration Appliances

WebSphere. software

Back-end applications

Centralized Management

Tivoli. software

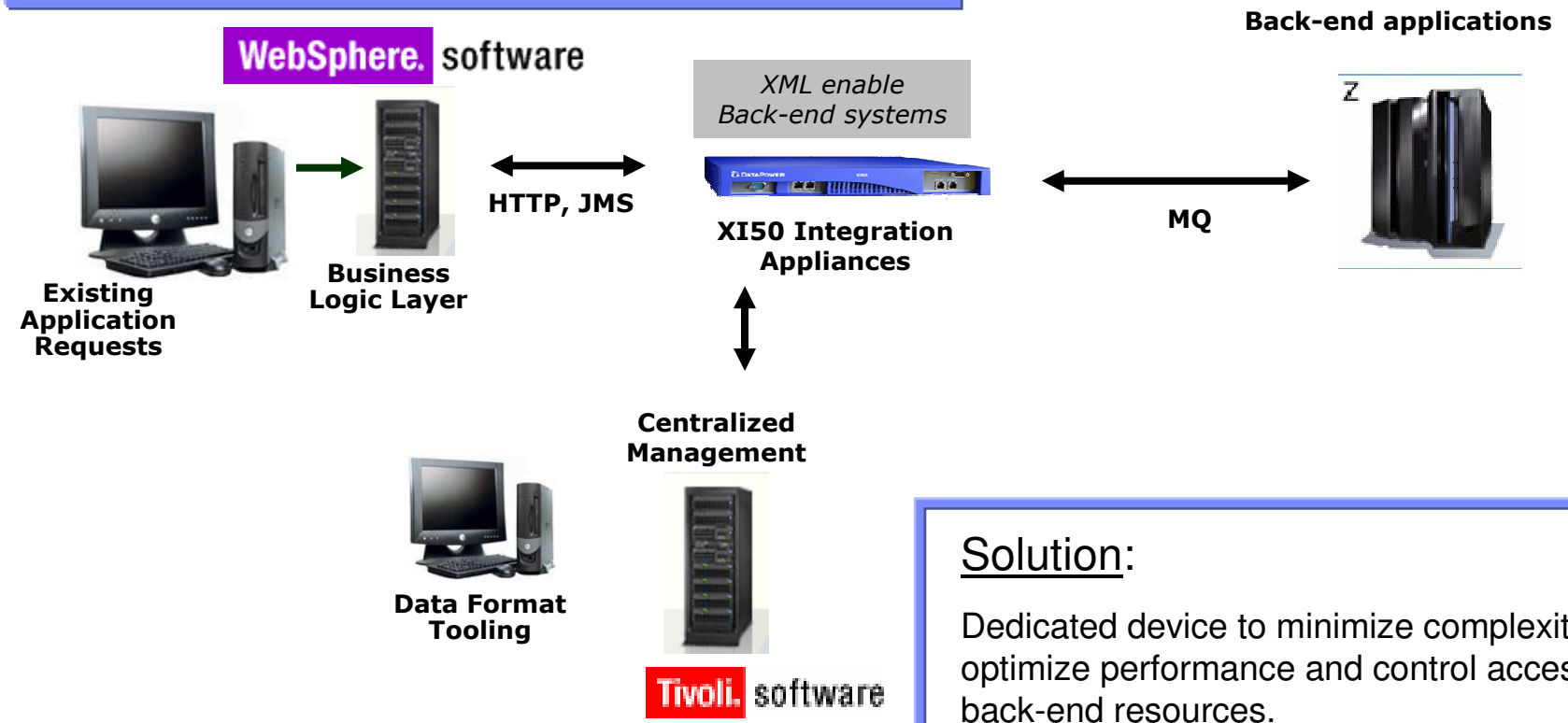
Solution:

Dedicated device to minimize complexity and optimize performance and utilization of resources within an SOA deployment. Efficient handling of messages, while ensuring security.

4 IBM Customers looking to **Simplify** Access to Back-end Systems via SOA

Case in point:

SOA enable back-end systems without deep Web Services technical skills.



Solution:

Dedicated device to minimize complexity and optimize performance and control access to back-end resources.

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Enterprise Service Bus Overview

IBM WebSphere Software Platform for Integration

ESB Brokering Patterns Concepts & Animations

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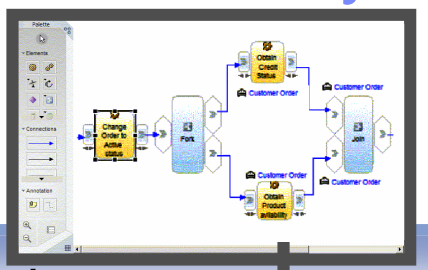
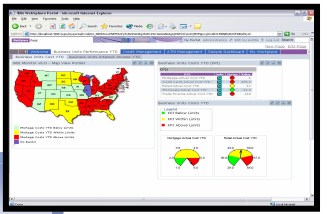
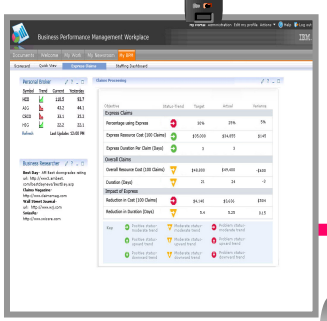
Business Flexibility enabled by SOA & WebSphere



Business dashboard





Development Services

Business Innovation & Optimization Services

Interaction Services

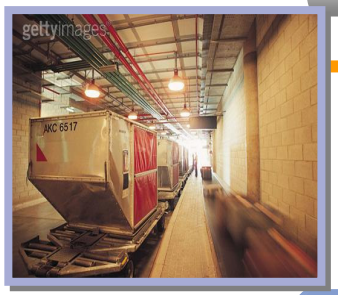
Portal

Process Services

Information Services

Federated Query

Connectivity Services



Community Manager

Partner Services

App EJBs

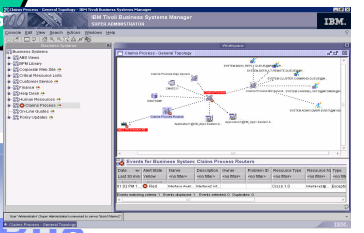
Business Application Services

Oracle Adapter

DB Access

App & Info Assets

IT impact on processes



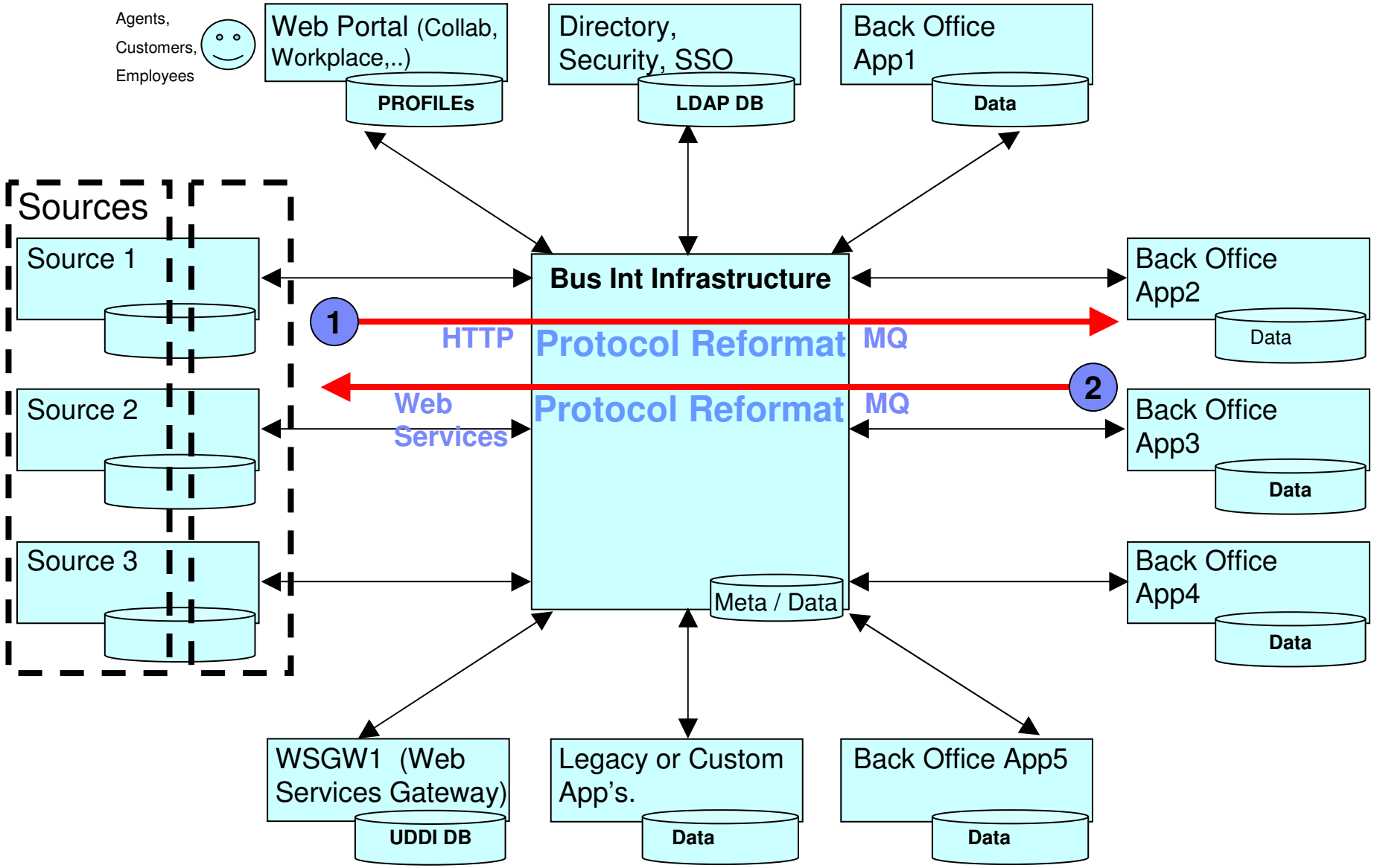
Infrastructure Management Services

In all cases, DATA flows across the ESB Enterprise Service Bus…

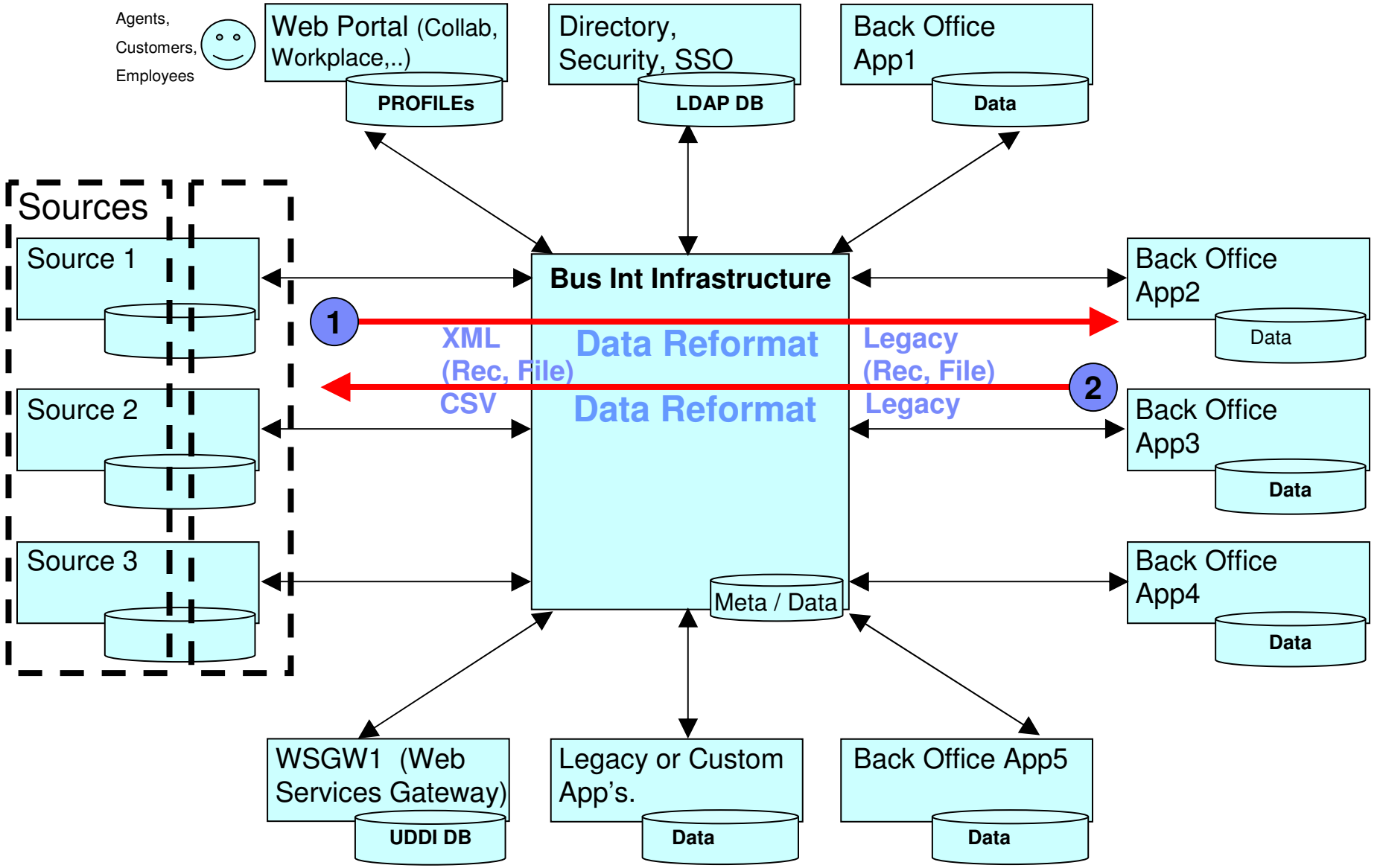
WMBv6 Message Broker Functions (Animated Patterns)

- Protocol Switch
- Data Reformat & Render
- Data ReShape
- Parse & Validate Data Structure & Content
- Route by Content
- Database to Message (Select lookup)
- Message to Database (Insert, Update, Delete)
- Fan-Out
- Fan-In
- Aggregate-Out + Aggregate-In
- Render Output, Send P2P (to Q), Pub\Sub (to Topic)
- DB+MQ Transact Commit
- DB+MQ Transact Rollback & Retry

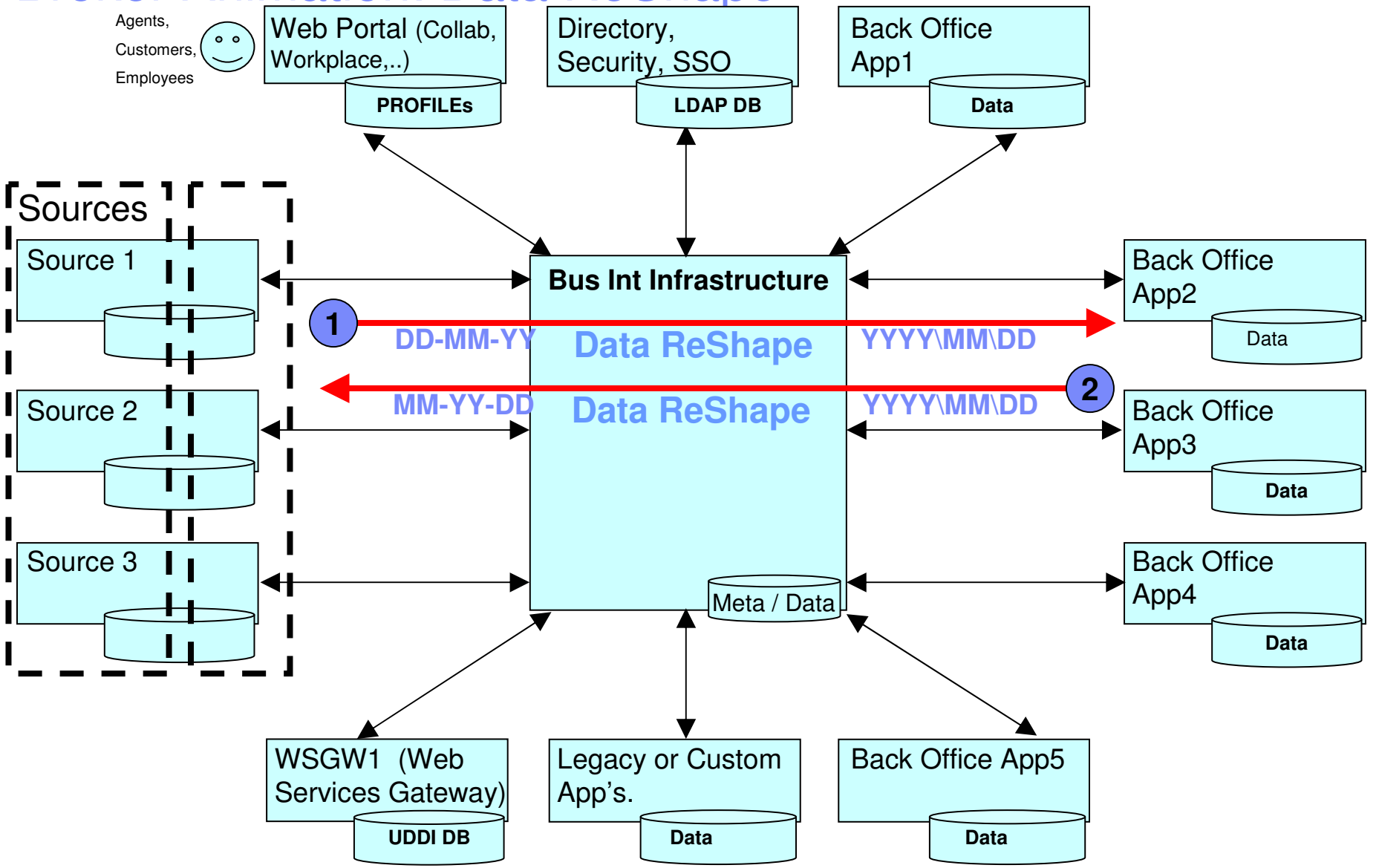
Broker Animation: Protocol Switch



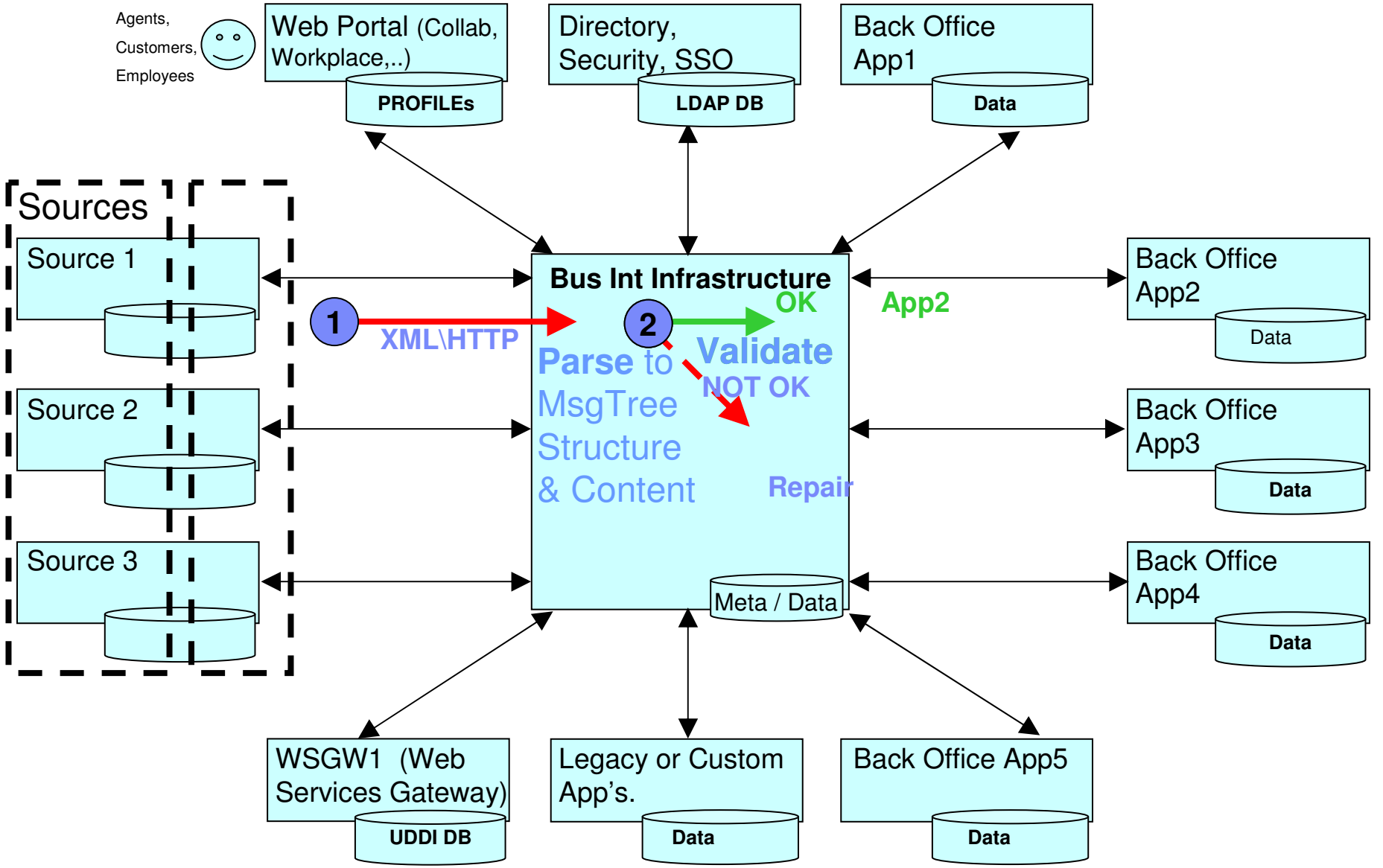
Broker Animation: Data Reformat & Render



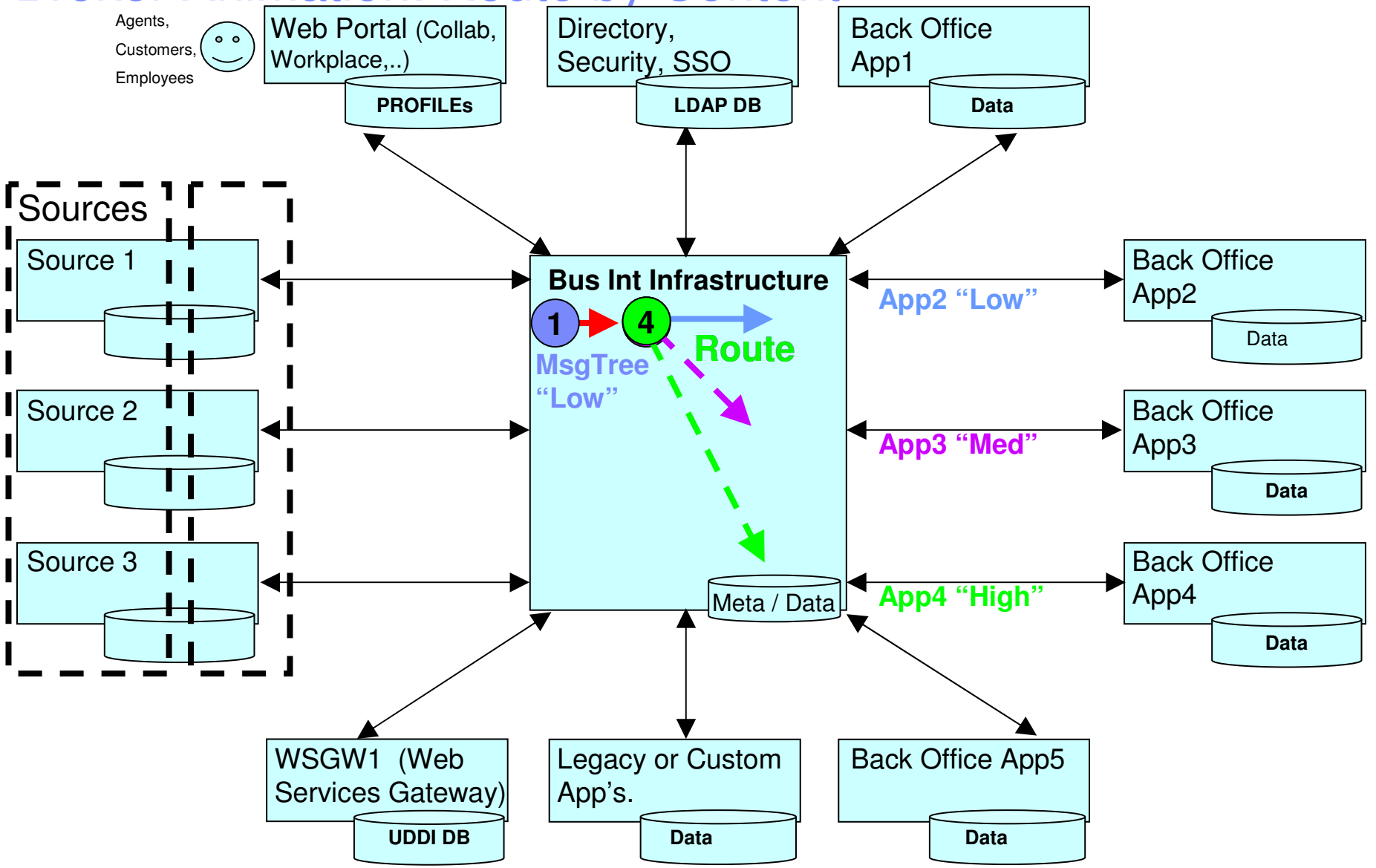
Broker Animation: Data ReShape



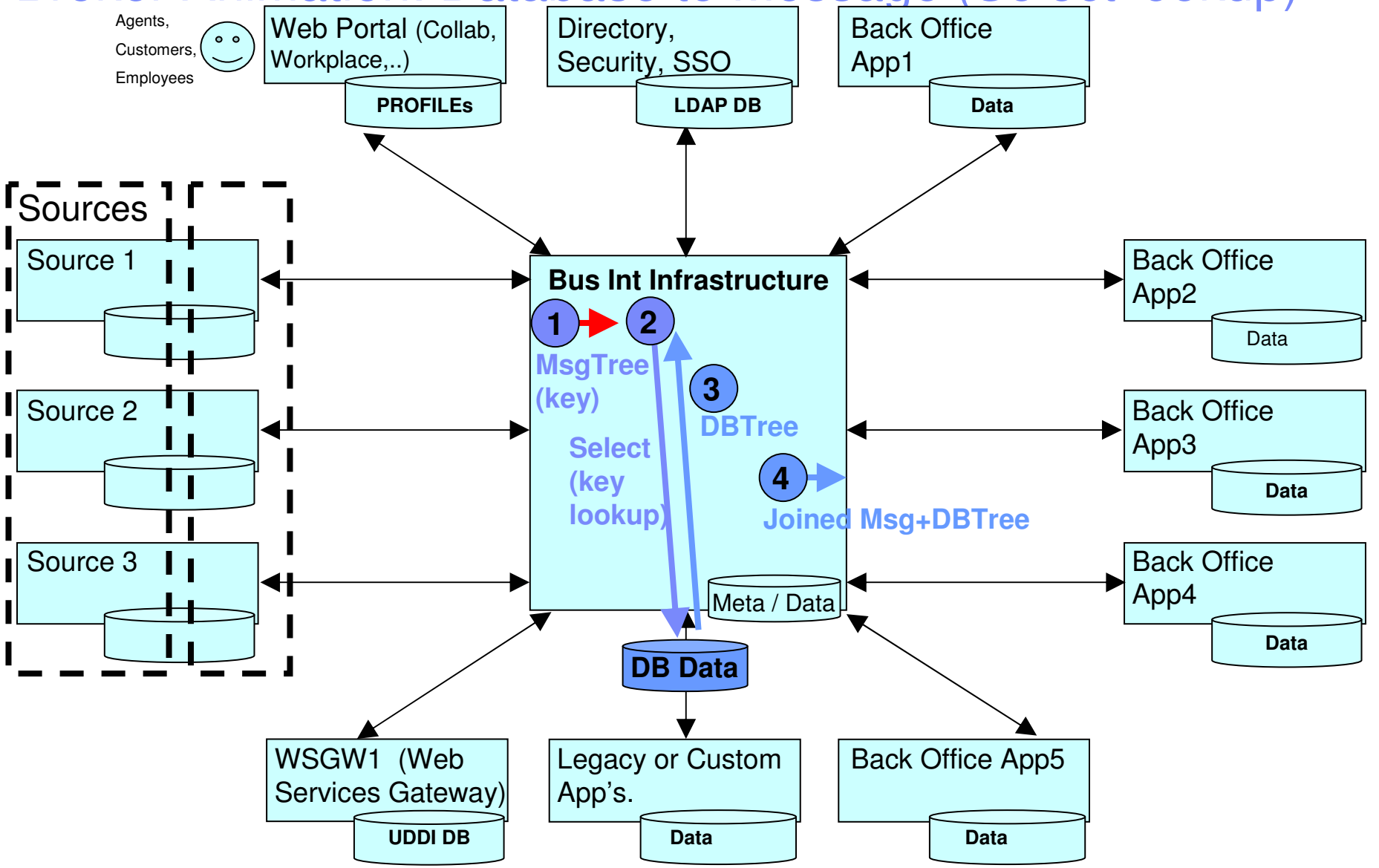
Broker Animation: Parse & Validate Data Structure & Content



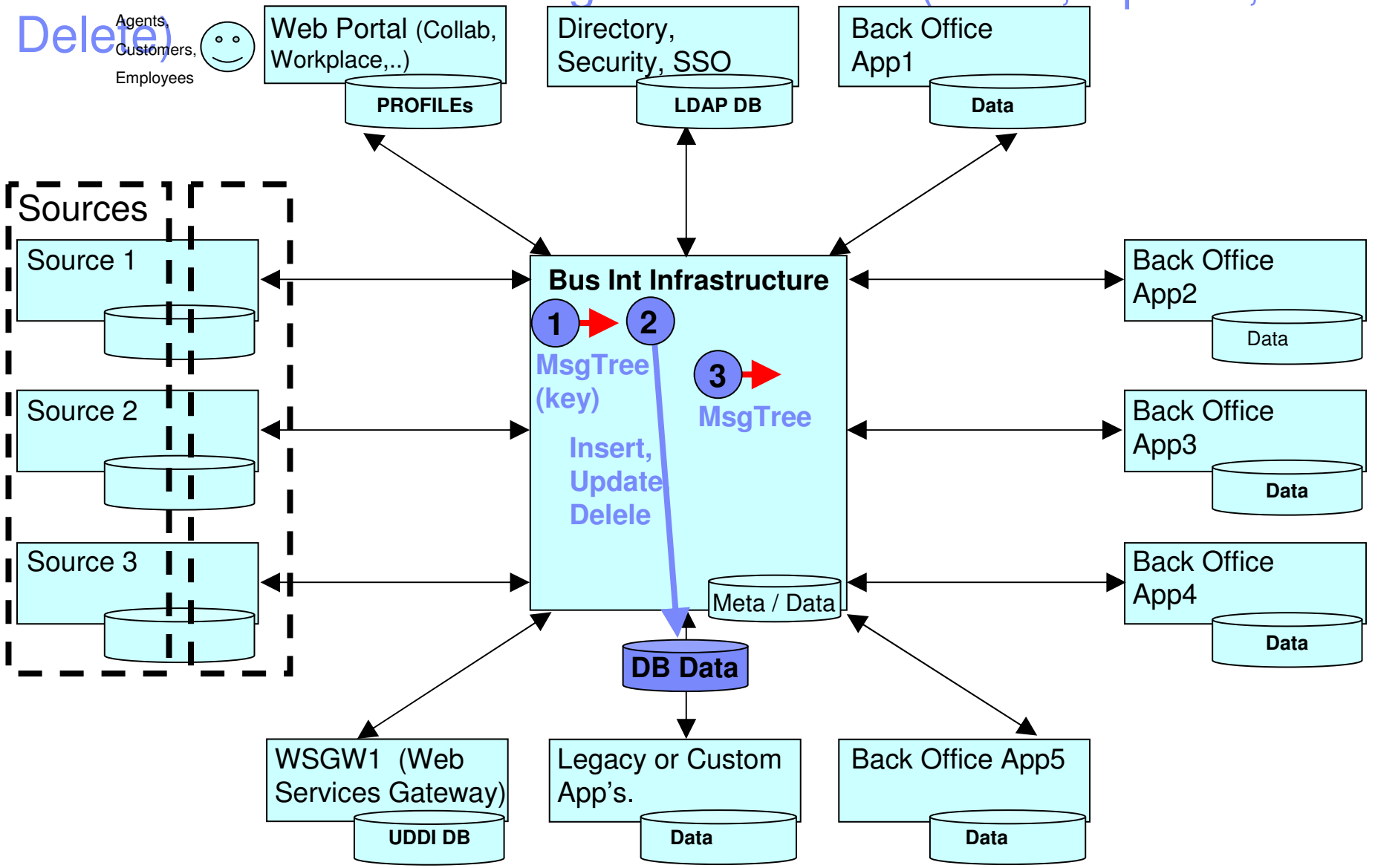
Broker Animation: Route by Content



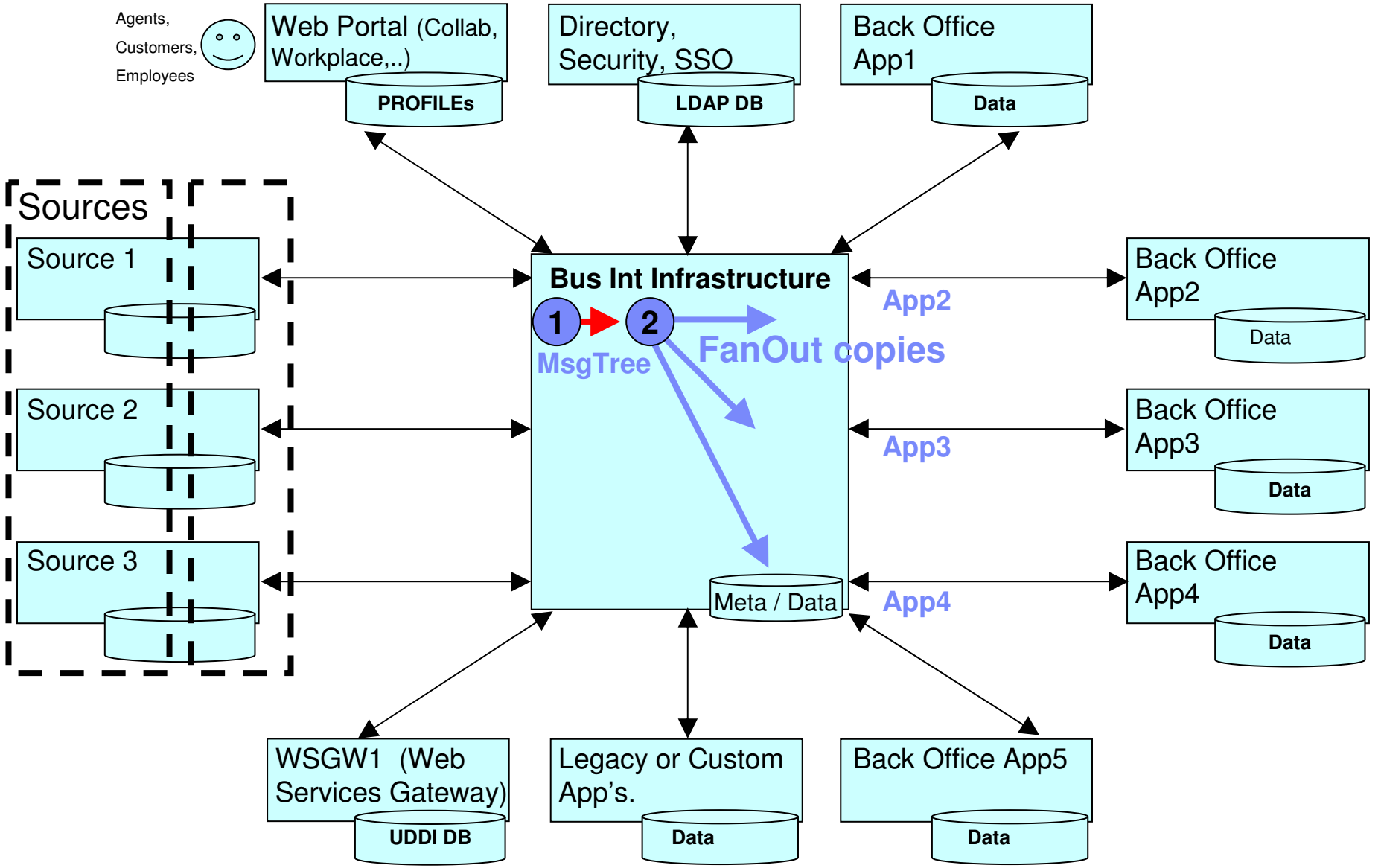
Broker Animation: Database to Message (Select lookup)



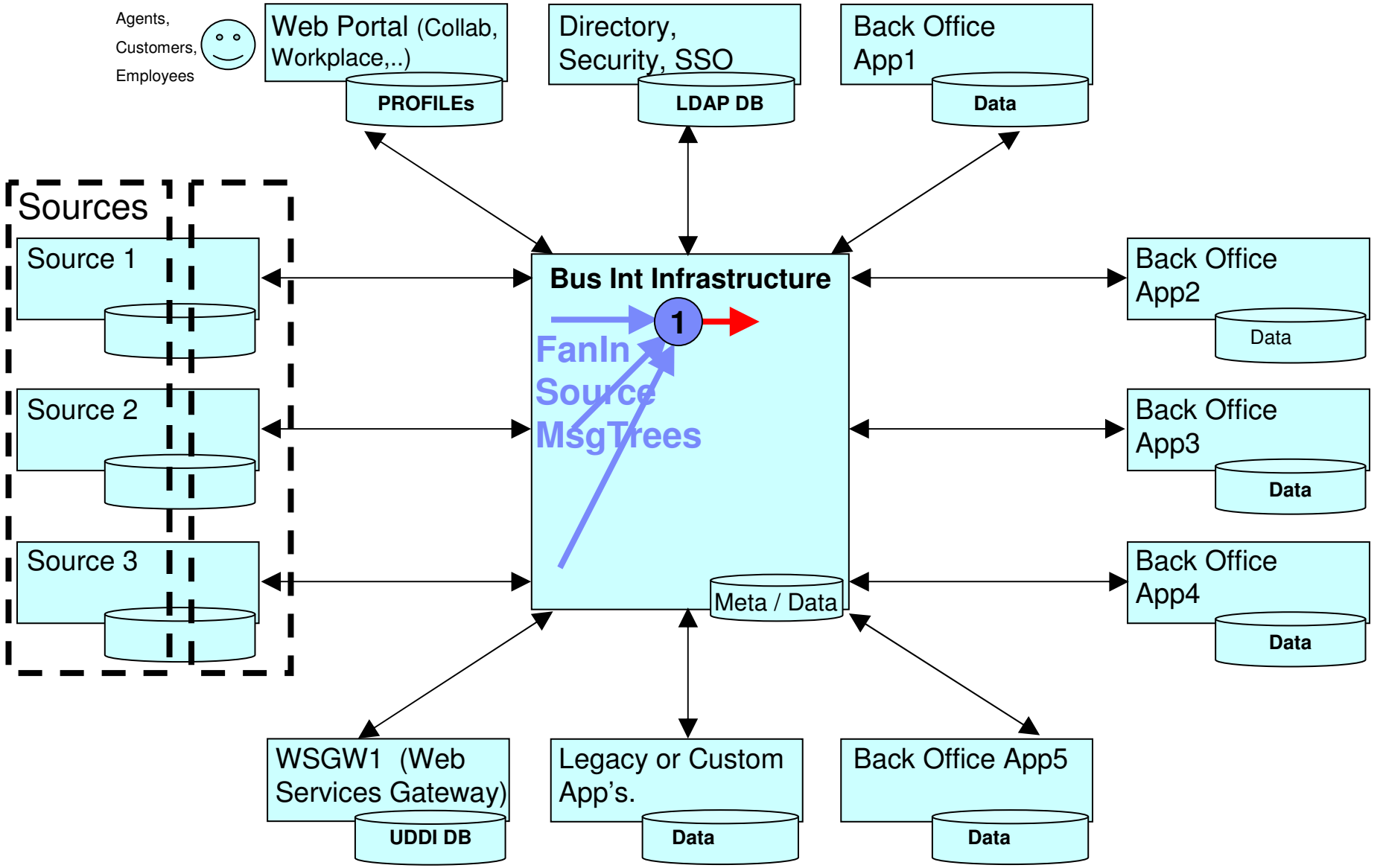
Broker Animation: Message to Database (Insert, Update, Delete)



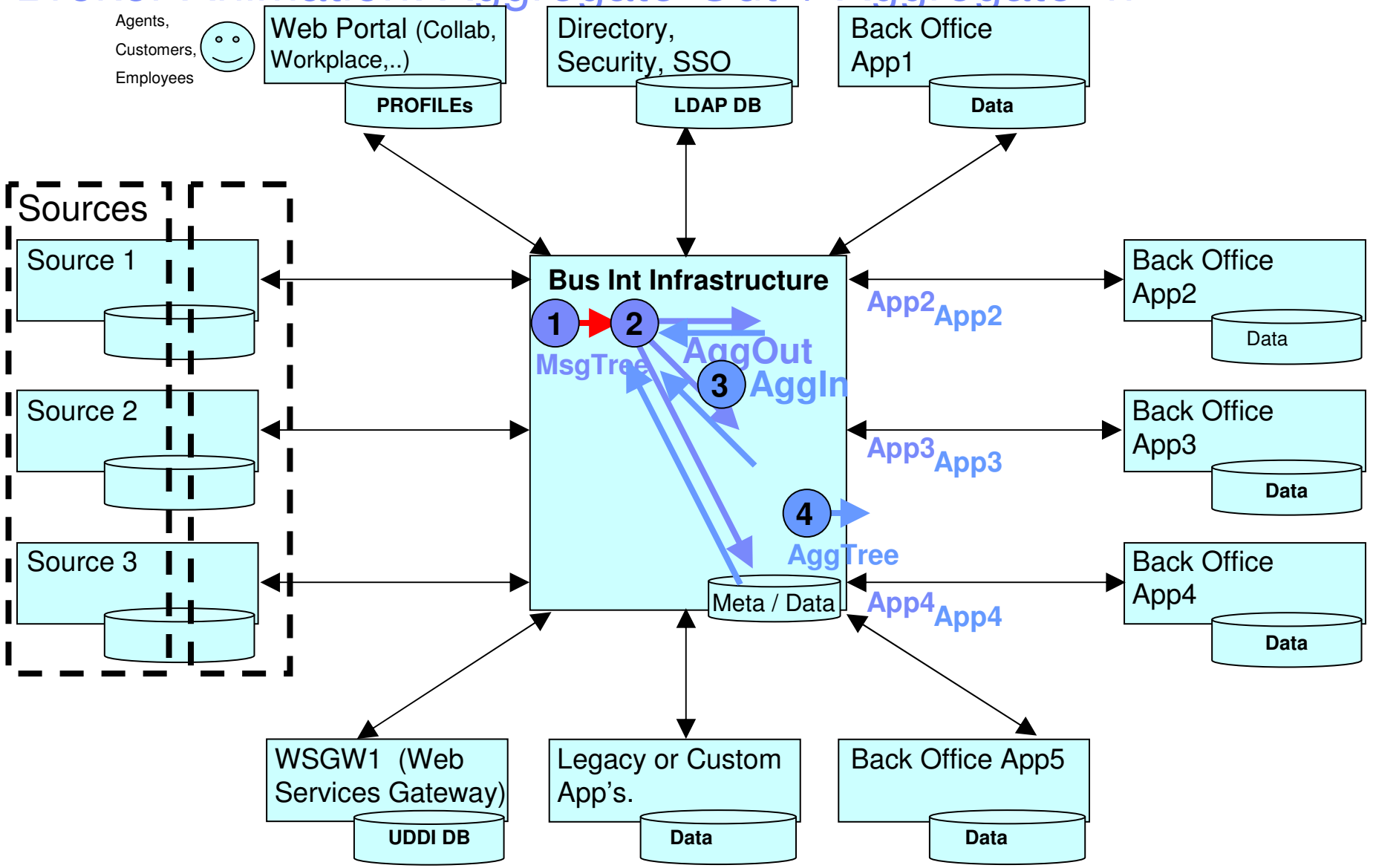
Broker Animation: Fan-Out



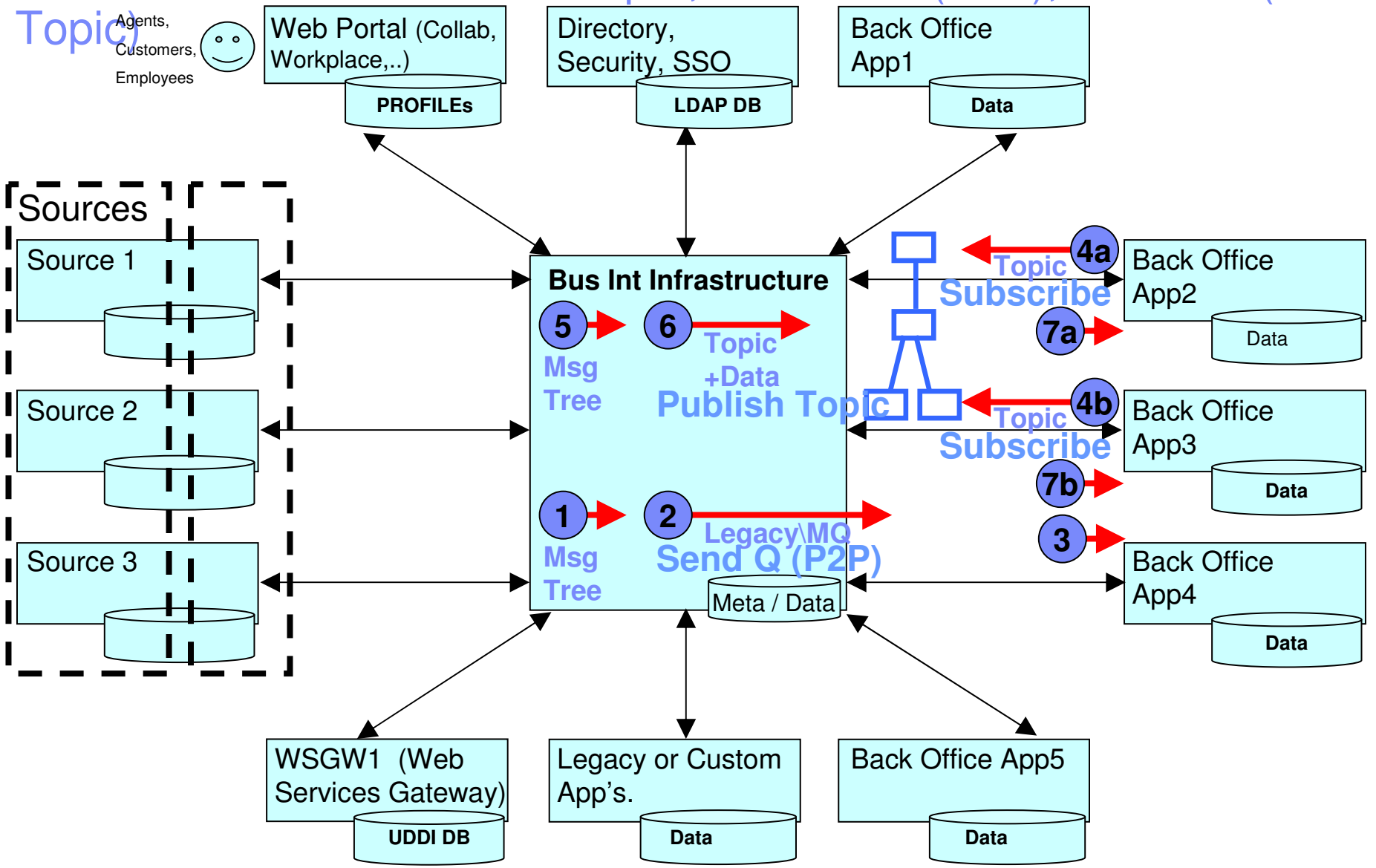
Broker Animation: Fan-In



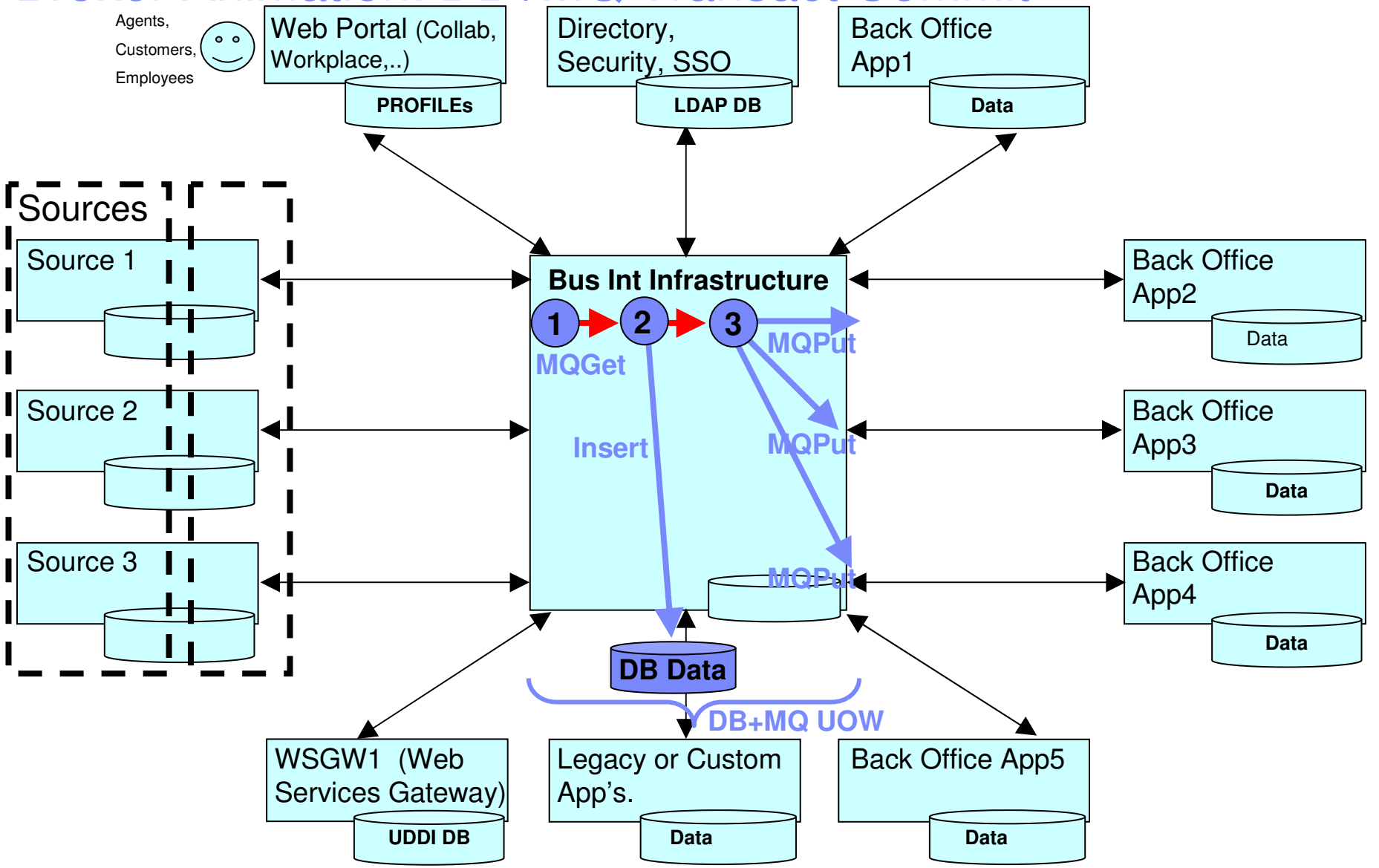
Broker Animation: Aggregate-Out + Aggregate-In



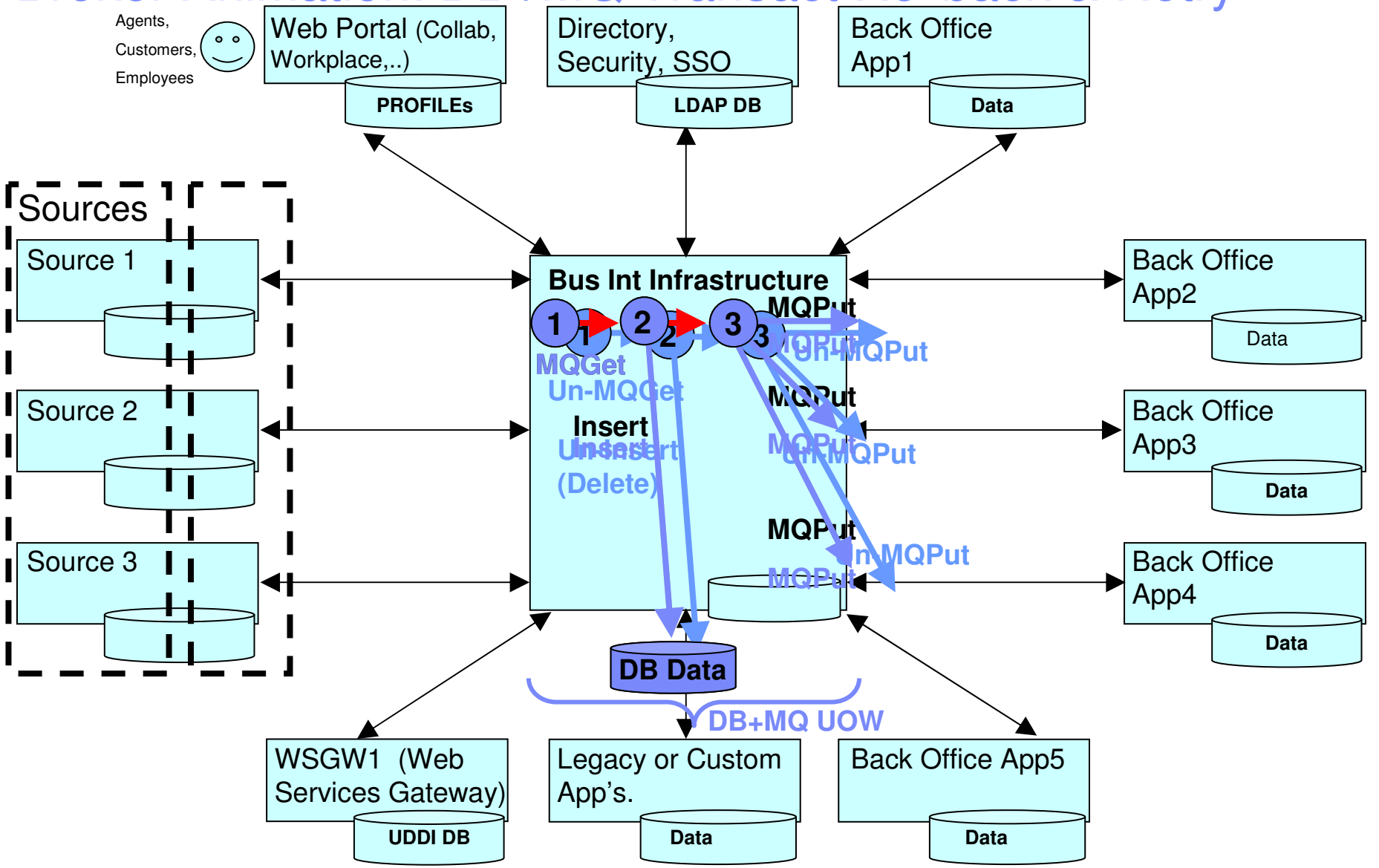
Broker Animation: Render Output, Send P2P (to Q), Pub\Sub (to Topic)



Broker Animation: DB+MQ Transact Commit



Broker Animation: DB+MQ Transact Rollback & Retry



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IBM WebSphere Software Platform for Integration

Summary

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Transformations and Mediations Summary

- Transformation and mediations across the SOA Reference Architecture has several capabilities.
- IBM products Websphere MB, WPS, WebSphere ESB, Partner Gateway support data transformations and mediations.
- These products can work together for a solution.
- ESB supports Data transformation
- WPS supports Business Objects transformation/
- WPS and WebSphere ESB have the same ESB transformations
- Non-Functional Requirements (performance) can used to determine the best transformation and mediation solution.

Business Value of an ESB \ Service-Oriented Architecture

Flexibility

- **Develop flexible business models enabled by increased granularity of business processes (“services”)**
- **Support an On-Demand business for globalization, outsourcing, mergers**

Speed

- **Combine and reuse pre-built service components for rapid application development and deployment in response to market change**

Efficiency

- **Integrate historically separate systems, facilitate mergers and acquisitions of enterprises**
- **Reduce cycle times and costs for external business partners by moving from manual to automated transactions**

Services & Info

- **Offer new services & information to customers without having to worry about the underlying IT infrastructure**

Revenue

- **Create new routes to market, new value from existing systems, growth**

Cost

- **Eliminate duplicate systems, build once and leverage**
- **Reusable assets cut costs**

Risk

- **Improve visibility into business operations**

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