IBM Software Group

IBM WebSphere Infrastructure for SOA & ESB

University of Toronto

Enterprise Service Bus (ESB), Adapters & Appliances

Advanced ESB Concepts (WMB)

Glen McDougall,

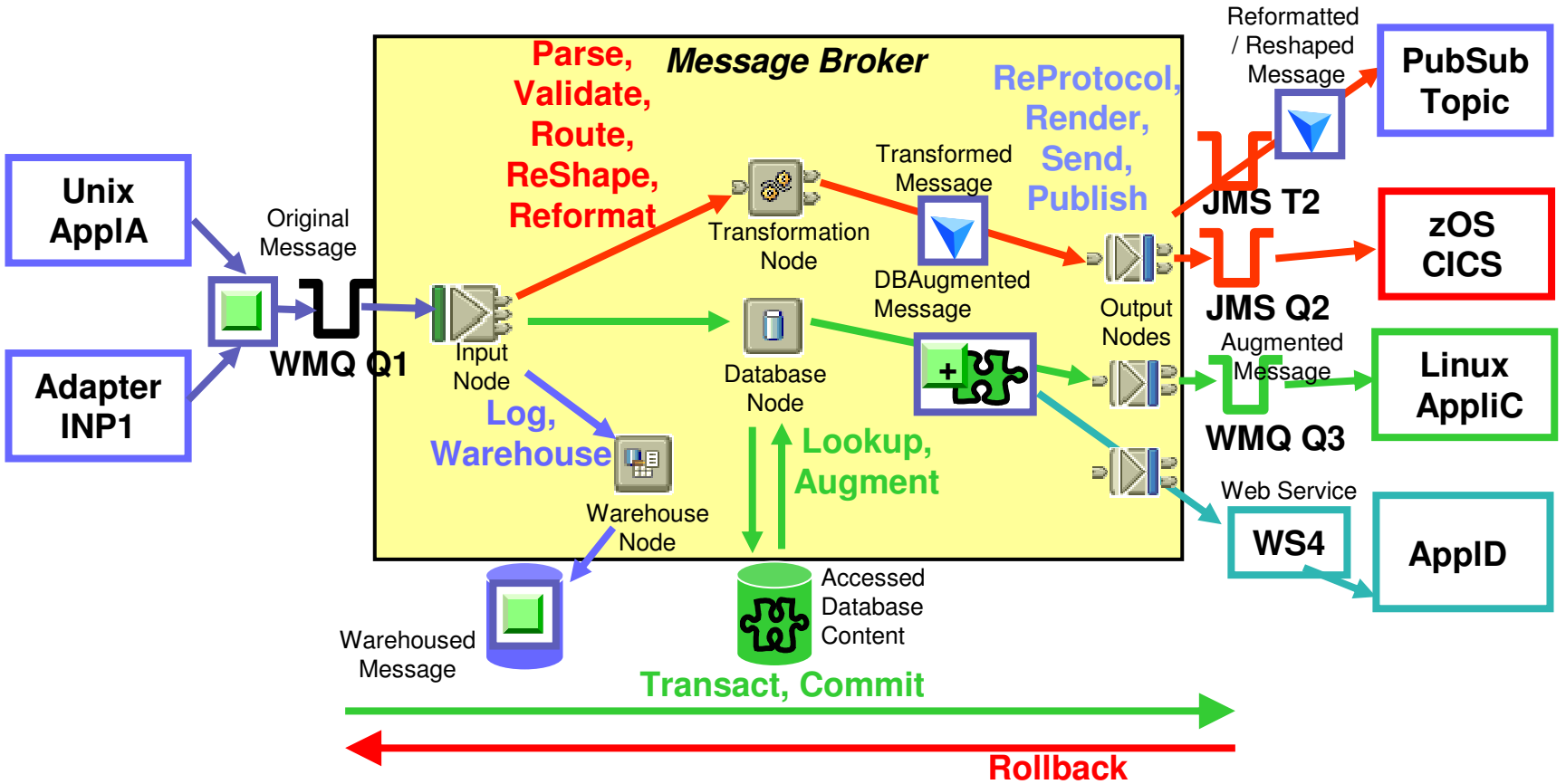
IBM Canada Ltd.

ON DEMAND BUSINESS

Version=

WebSphere Message Broker …

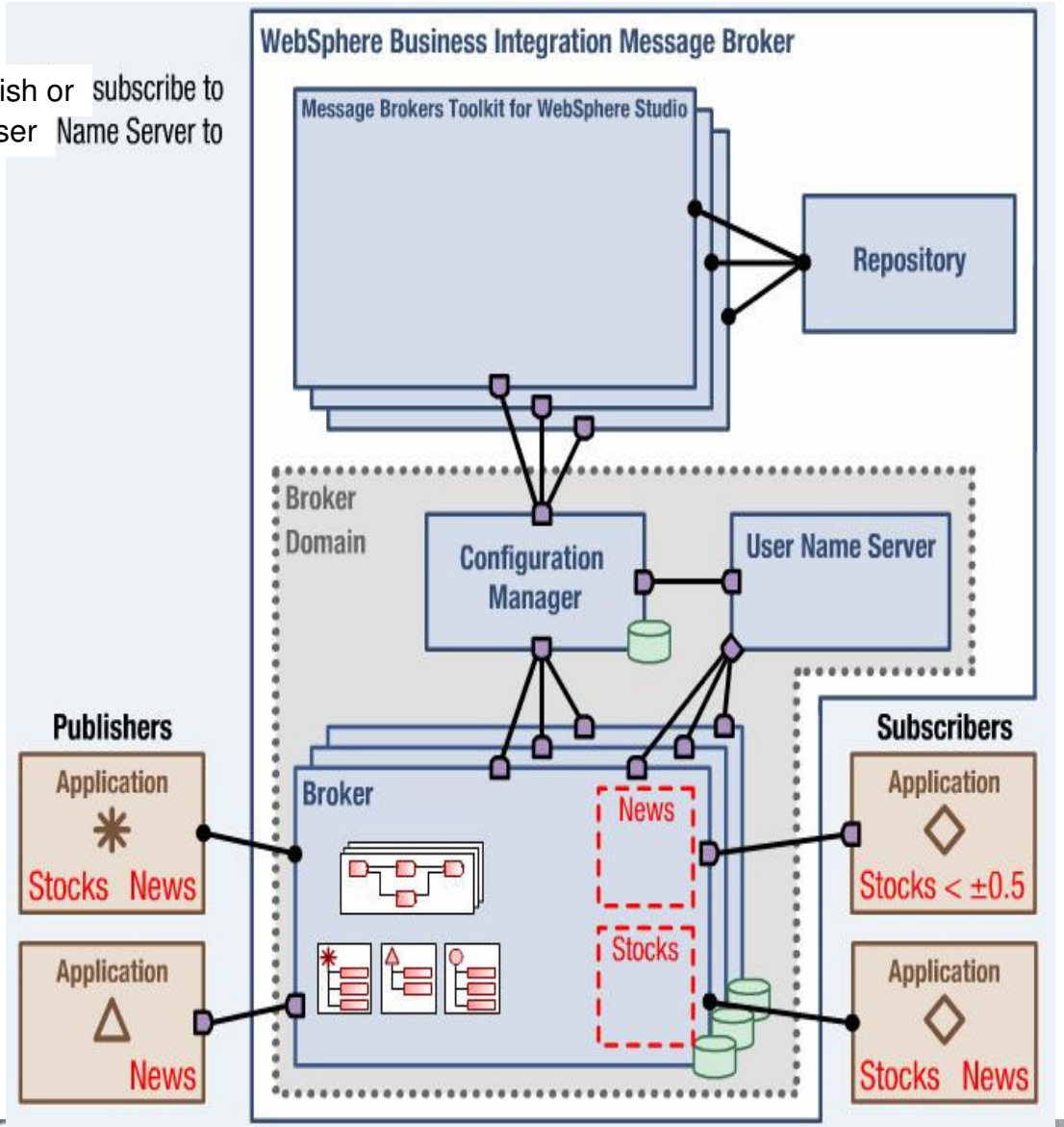
… Delivers the right message in the right format



- Examines Protocol\Header\Message
- Routes & Fans-out Message
- Reshapes & Reformats Content

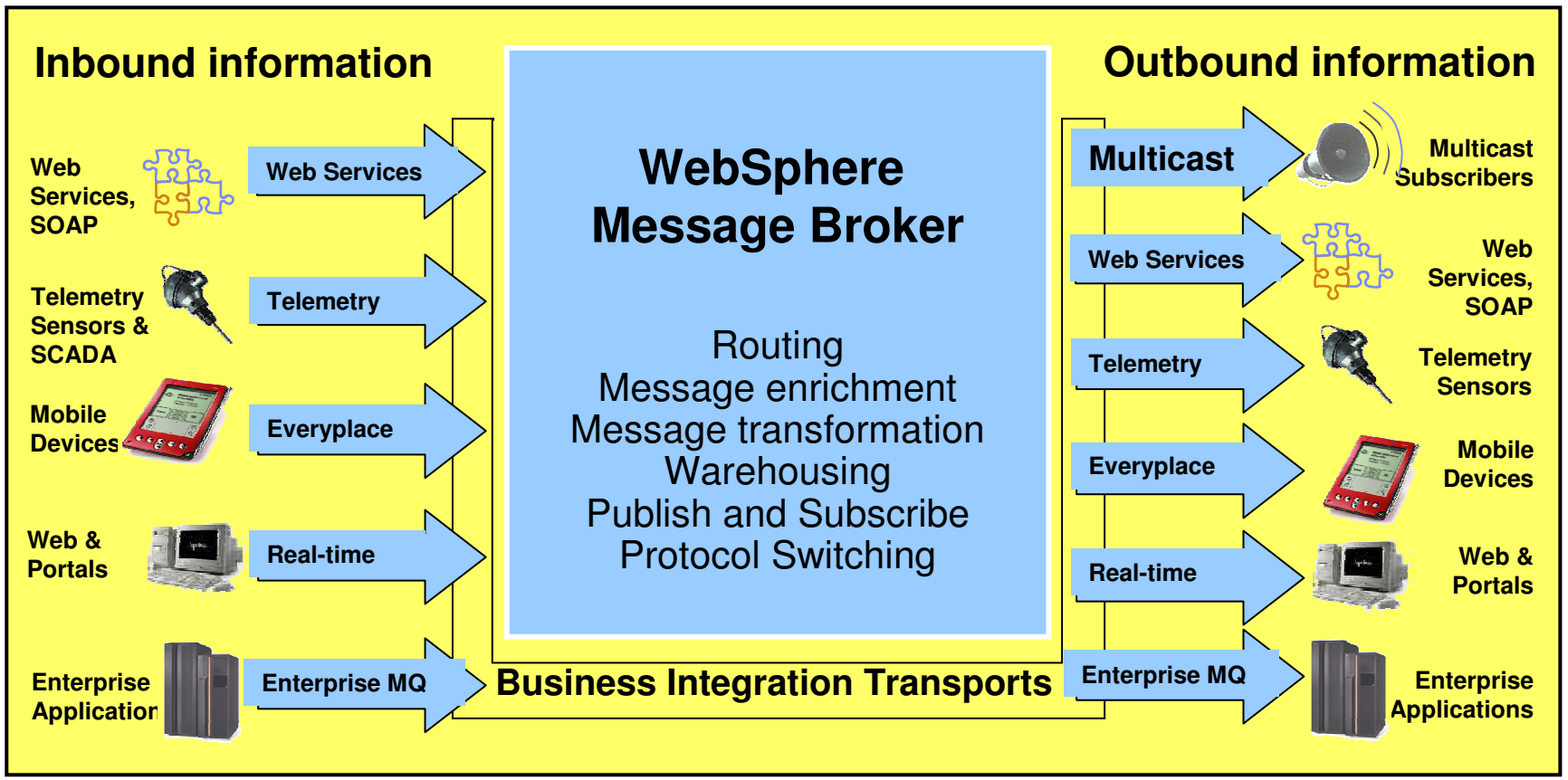
- Augments Message with DB lookup
- Warehouses\Logs Message to DB
- and assures Transactional Delivery !

WMBv6 Architecture



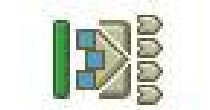
WMBv6 Business Integration Input / Output Transports

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

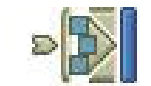


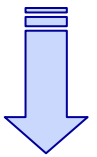
WMBv6 -Message Broker File Extender (MBFE)

- Extends WMBv6 (or WBIMBv5) by adding the ability to process data held in local files (eg on broker runtime platform)
- Reuse & leverage existing file-based applications and data



Read/write data from/to specified locations in file system





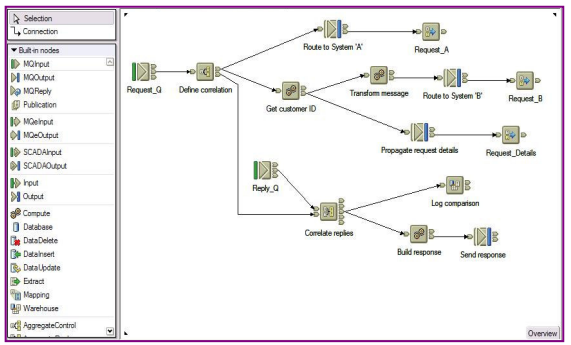
Supports:
- File-to-File
- File-to-Message
- Message-to-File

Propagate:
- Whole file in a single iteration
- Record by Record
- File descriptor only

- Uses staging directories on both input and output to avoid file overwrite or processing of incomplete files
- Automatic clean-up of unprocessed files
- Transactional commit files by batch or entire job

What is WebSphere Message Broker?

1. **A framework for processing MQ messages**



2. **Broad support for transport protocols beyond MQ**

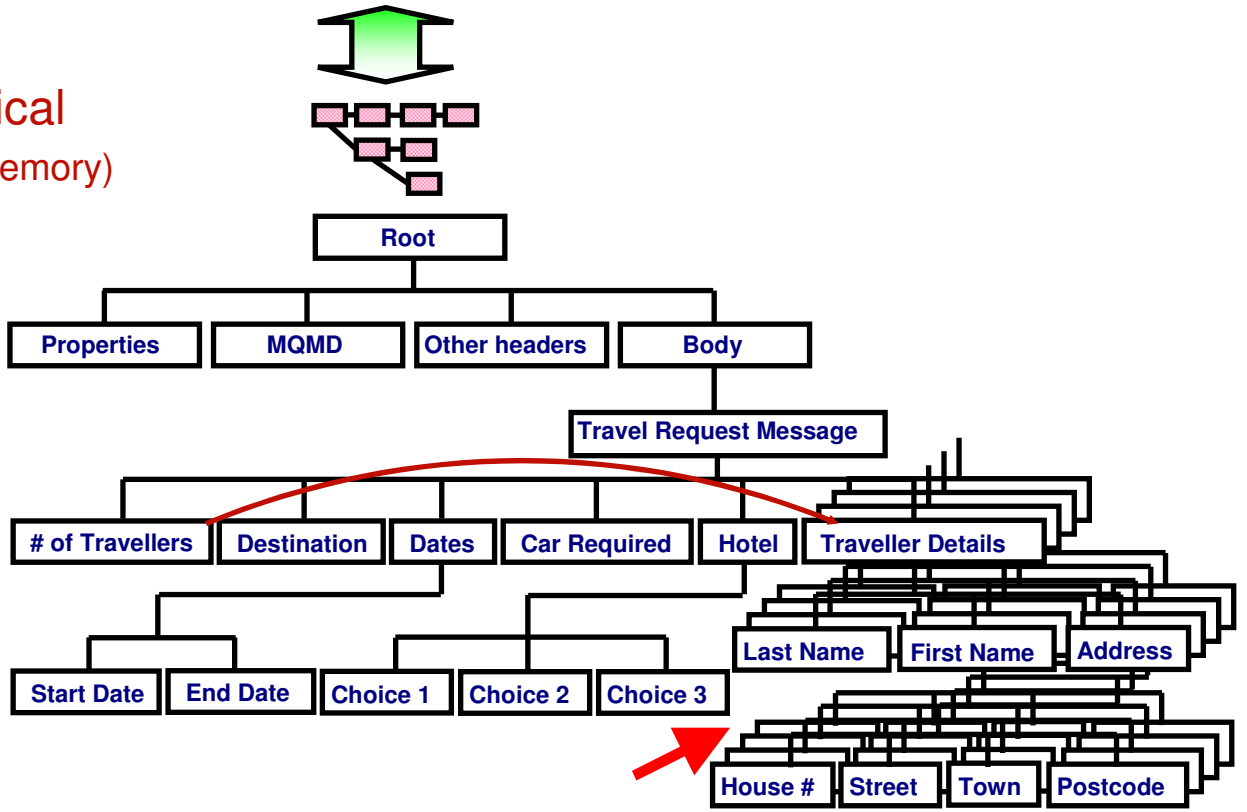
3. **A robust hosting environment for:**
   - ✓ Transforming data
   - ✓ Enriching data
   - ✓ Interacting with databases
   - ✓ Routing messages based on content
   - ✓ Detecting complex combinations of messages
   - ✓ Interacting existing applications with Web Services

4. **Built on a platform for:**
   - ✓ End-to-end transactionality
   - ✓ Scalability
   - ✓ Load balancing
   - ✓ High availability
   - ✓ Manageability

WMBv6 Message Model – Sample Logical Message

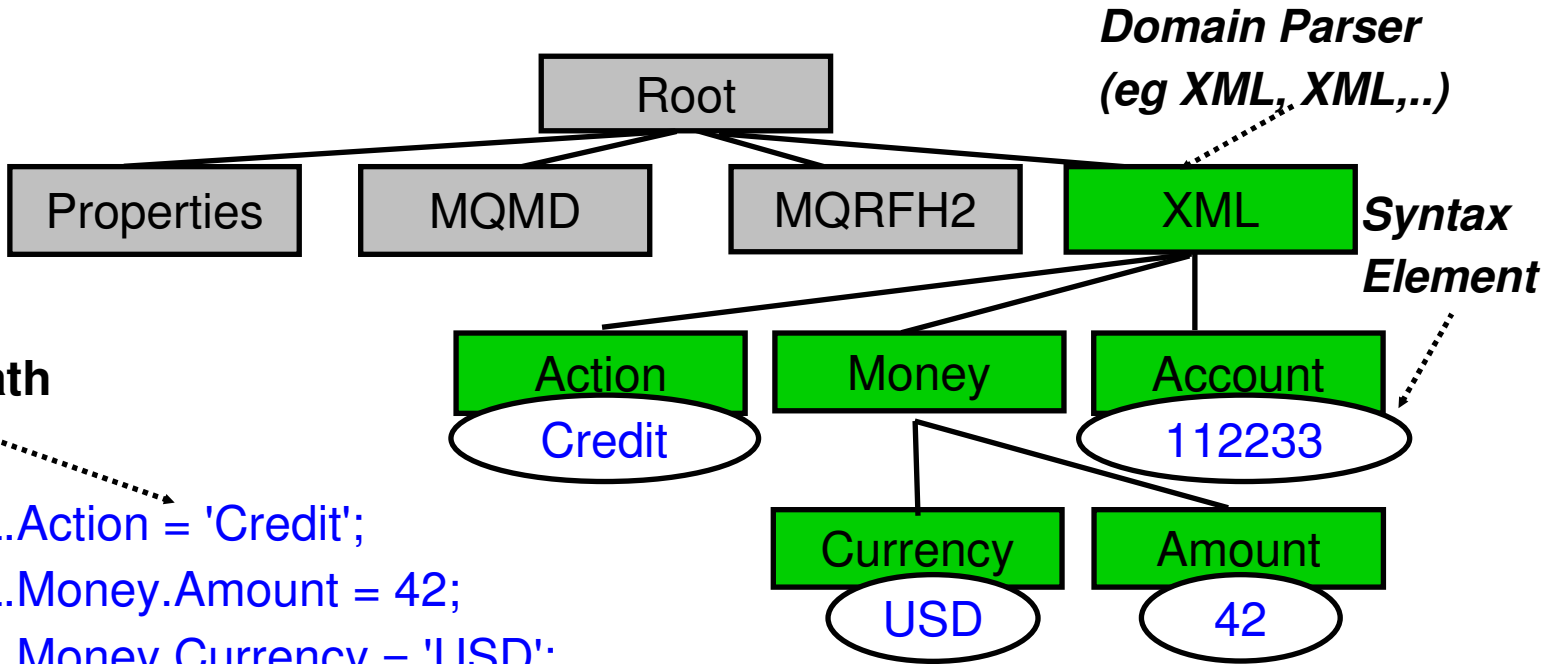
Physical
(On Wire)

Logical
(In Memory)



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

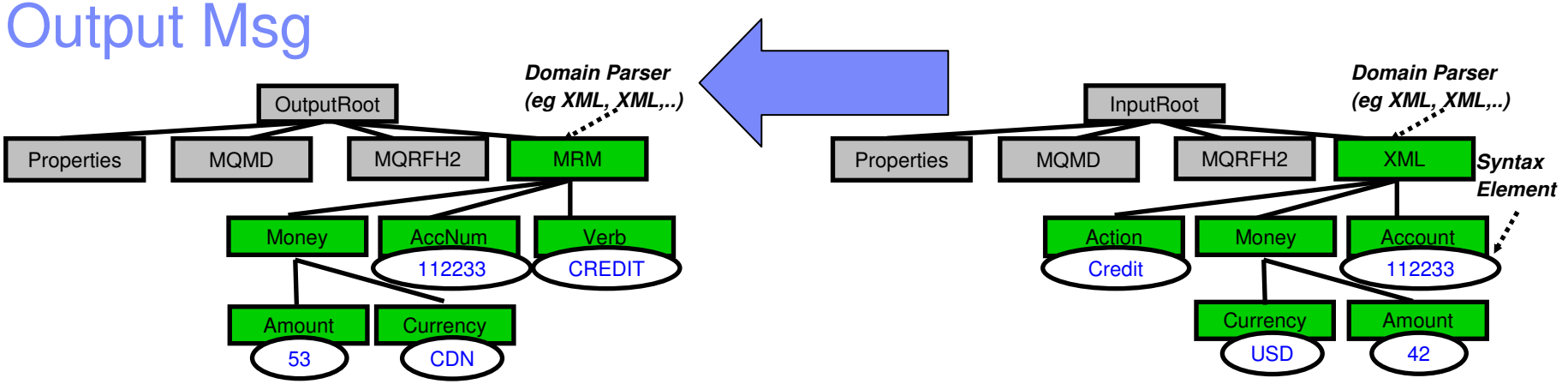
WMBv6 Logical message tree –ESQL to Set Initial Values



ESQL path

```
Set Root.XML.Action = 'Credit';
Set Root.XML.Money.Amount = 42;
Set Root.XML.Money.Currency = 'USD';
Set Root.XML.Account = '112233';
```

WMBv6 Logical message tree –ESQL to Reshape Input to Output Msg



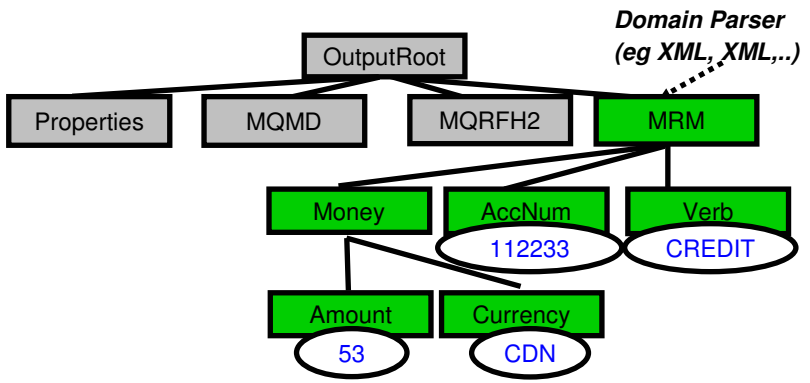
ESQL code to reshape \ mapping input to output: (GUI D&D also creates ESQL)

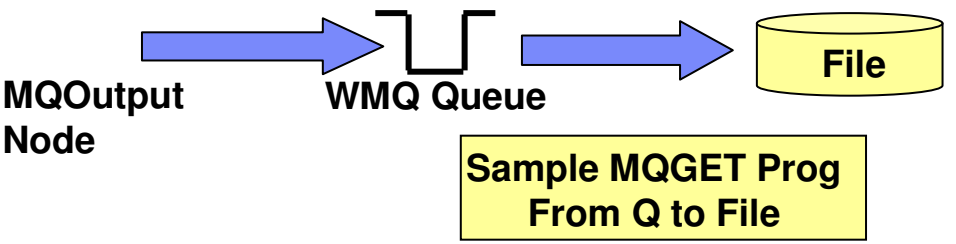
```
Set OutputRoot.MRM.Money.Amount = InputRoot.XML.Money.Amount * 1.6; -- Math
Set OutputRoot.MRM.Money.Currency = 'CDN';  -- Assign Literal
Set OutputRoot.MRM.AccNum = InputRoot.XML.Account;  -- Rename Tag & Assign
Set OutputRoot.MRM.Verb = UPPER( InputRoot.XML.Account );  -- SQL99 Function

-- You can also join any Message or Database sub-trees with a WHERE clause
-- Set OutputRoot.MRM.MySubTree =
--     SELECT ... M.Fld3, D.Col5, ..  FROM .. AS  ..   WHERE M.Key1 = D.Key2
```

Use "GUI Drag and Drop Mapping", or "XSLT Mapping, or "ESQL Coding"

WMBv6 Tree -ESQL to Render Logical message tree into MQ Flat Record



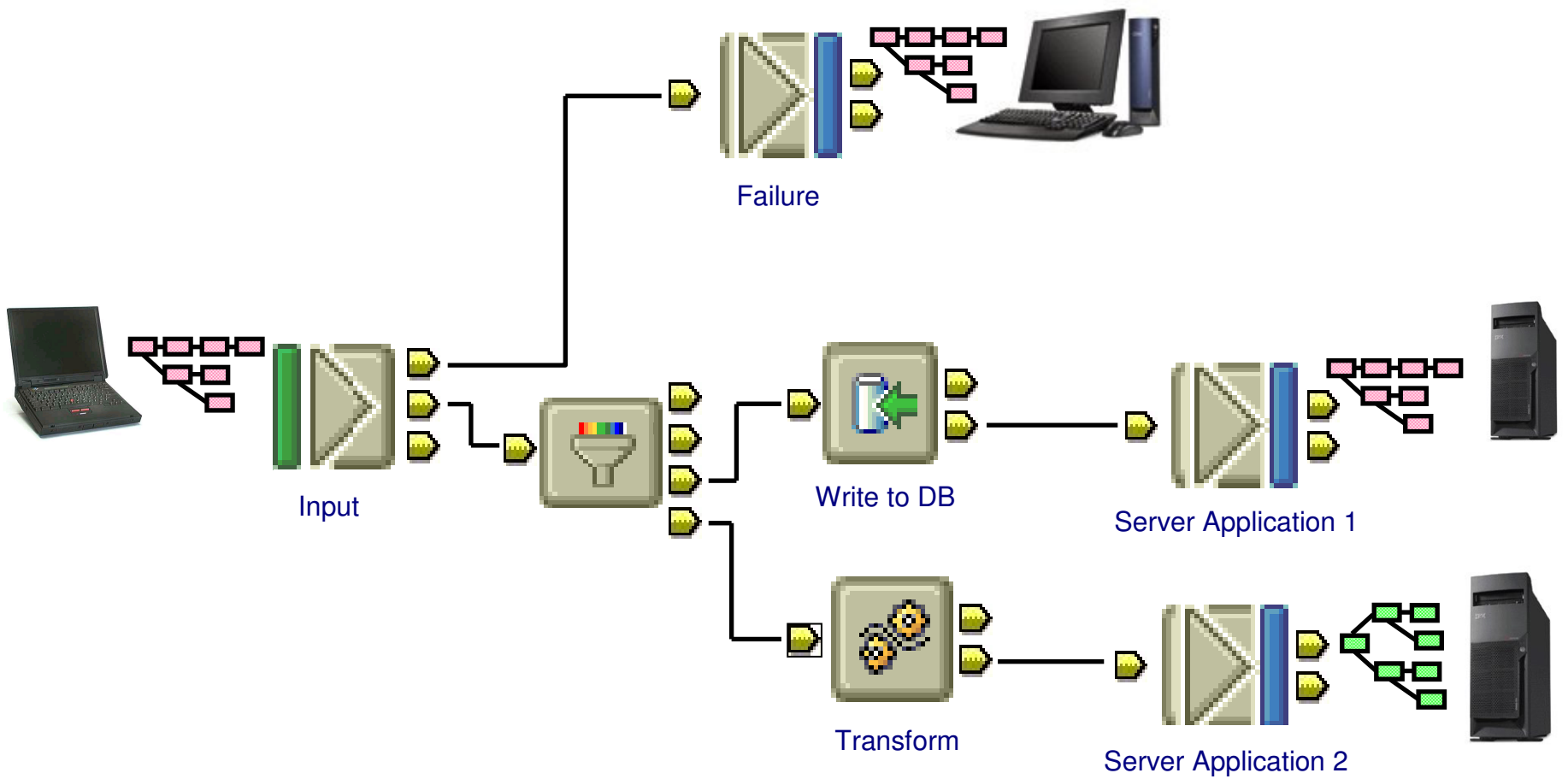


ESQL code to Render Logical Tree to Legacy format

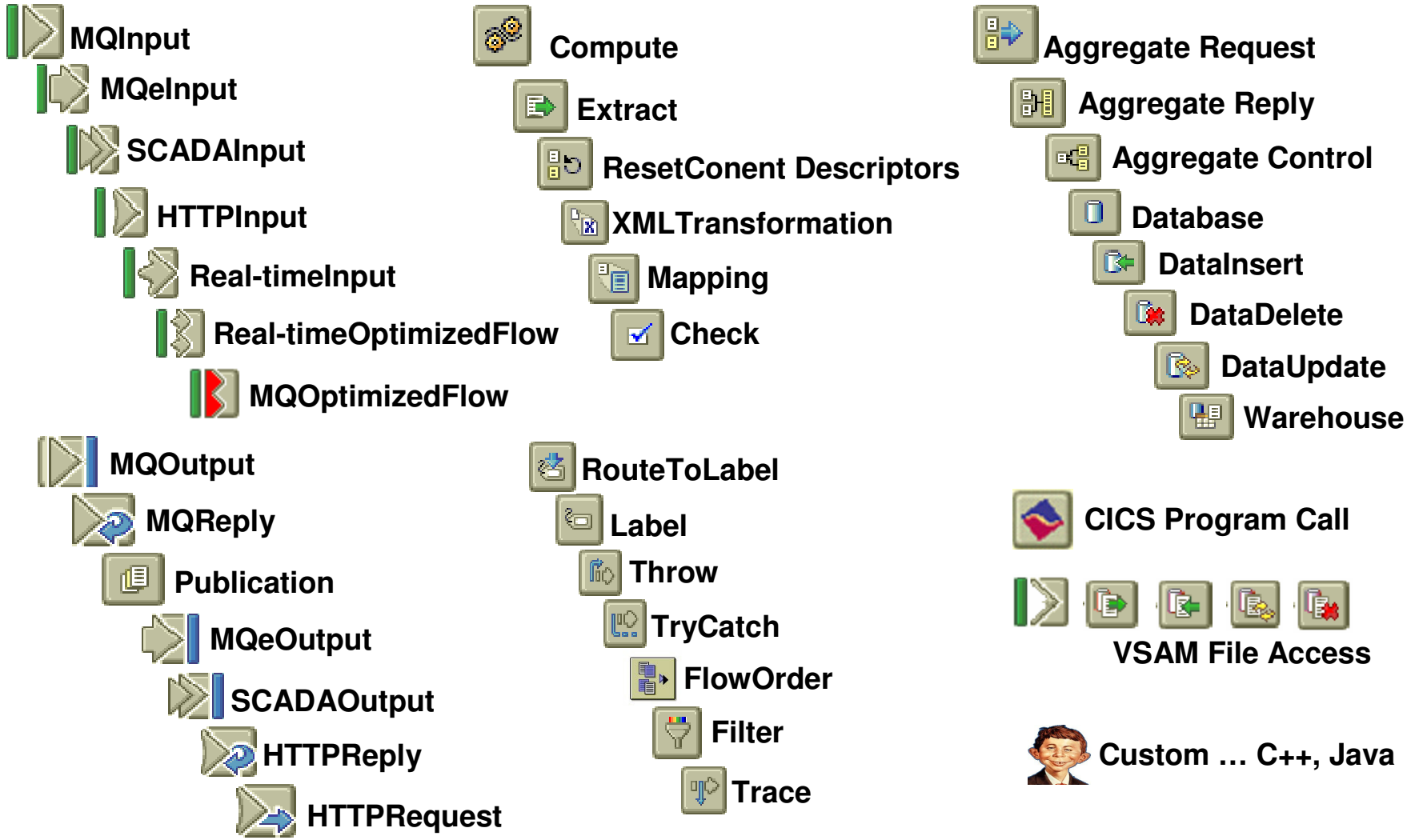
Set OutputRoot.Properties.Format = 'MRM';

One ESQL Statement to Flatten logical tree into a Legacy record & Put onto a WMQ Queue

WMBv6 -Message Flows



WMBv6 -Typical Message Flow Nodes



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
- ...

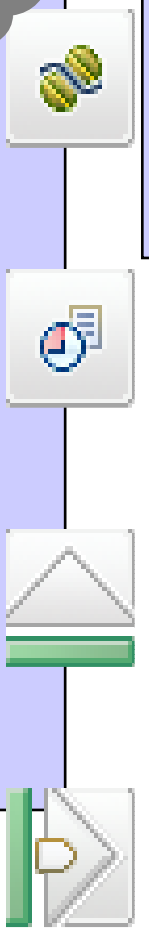
Statements
- Basic
  - DECLARE
  - SET
  - IF ENDIF
  - WHILE
- Tree
  - MOVE
  - CREATE
  - DETACH
  - ATTACH
- Database
  - INSERT
  - DELETE
  - UPDATE
  - PASSTHRU
  - EVAL
- Node
  - PROPAGATE
  - RETURN
  - THROW
  - ...

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 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** nodes
  - Native JMS Interoperability



Now Available

- **DataStage TX node**
  - Run existing DSTX/Mercator maps unchanged
  - Leverage extended capabilities
- **File node** (eg MBFE,..)
  - ability to process data held in files

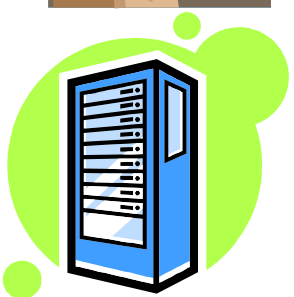
Updated

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

WMBv6 Web Services Support –"Wrap MF & Invoke WS"

- 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,
  - Document and RPC 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
  - HTTP 1.1, HTTPS
- Built-in WS-I Compliance checking for WSDL
  - Automatically validates WSDL against the WS-I Basic Profile (at RT too)

WMBv6 -Departmental Chargeback



Dept A

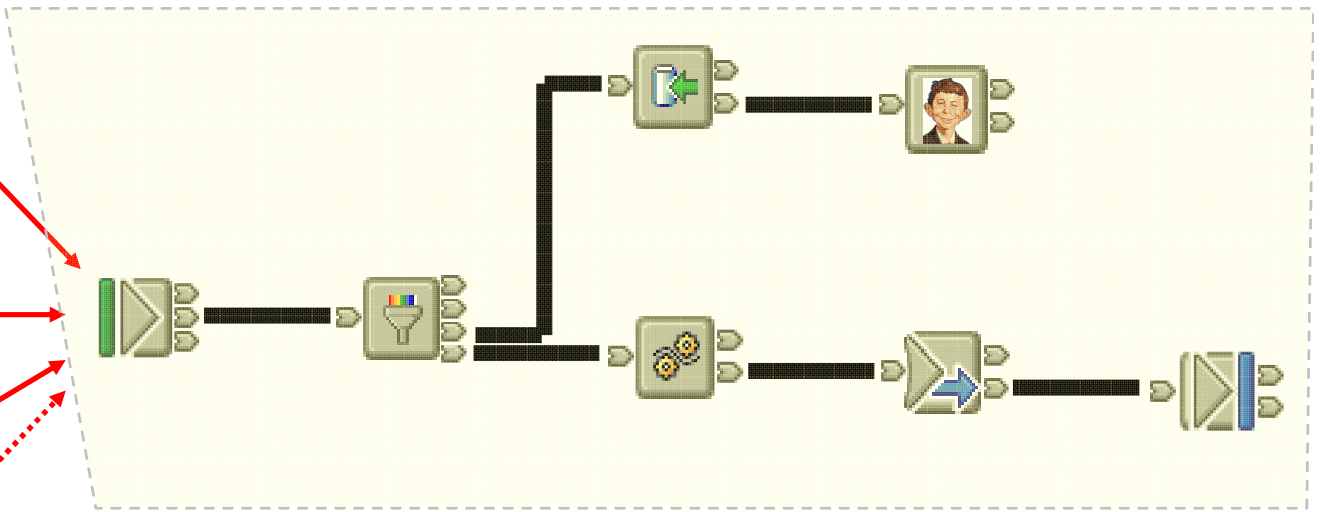
Dept B

Dept C

(Anonymous)

...

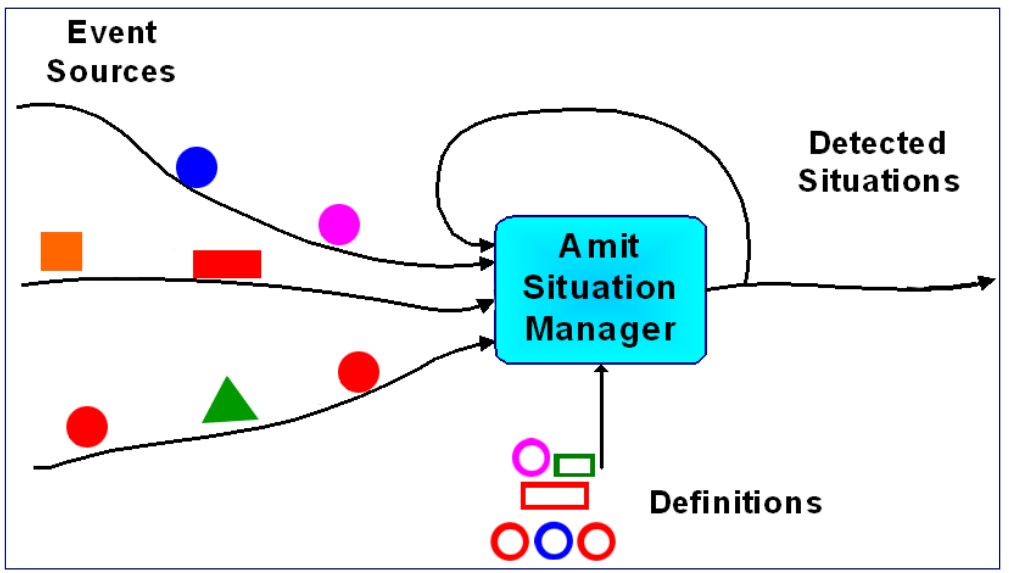
Q: Who pays for this message mediation?



A: Use WebSphere Message Broker Accounting and Statistics

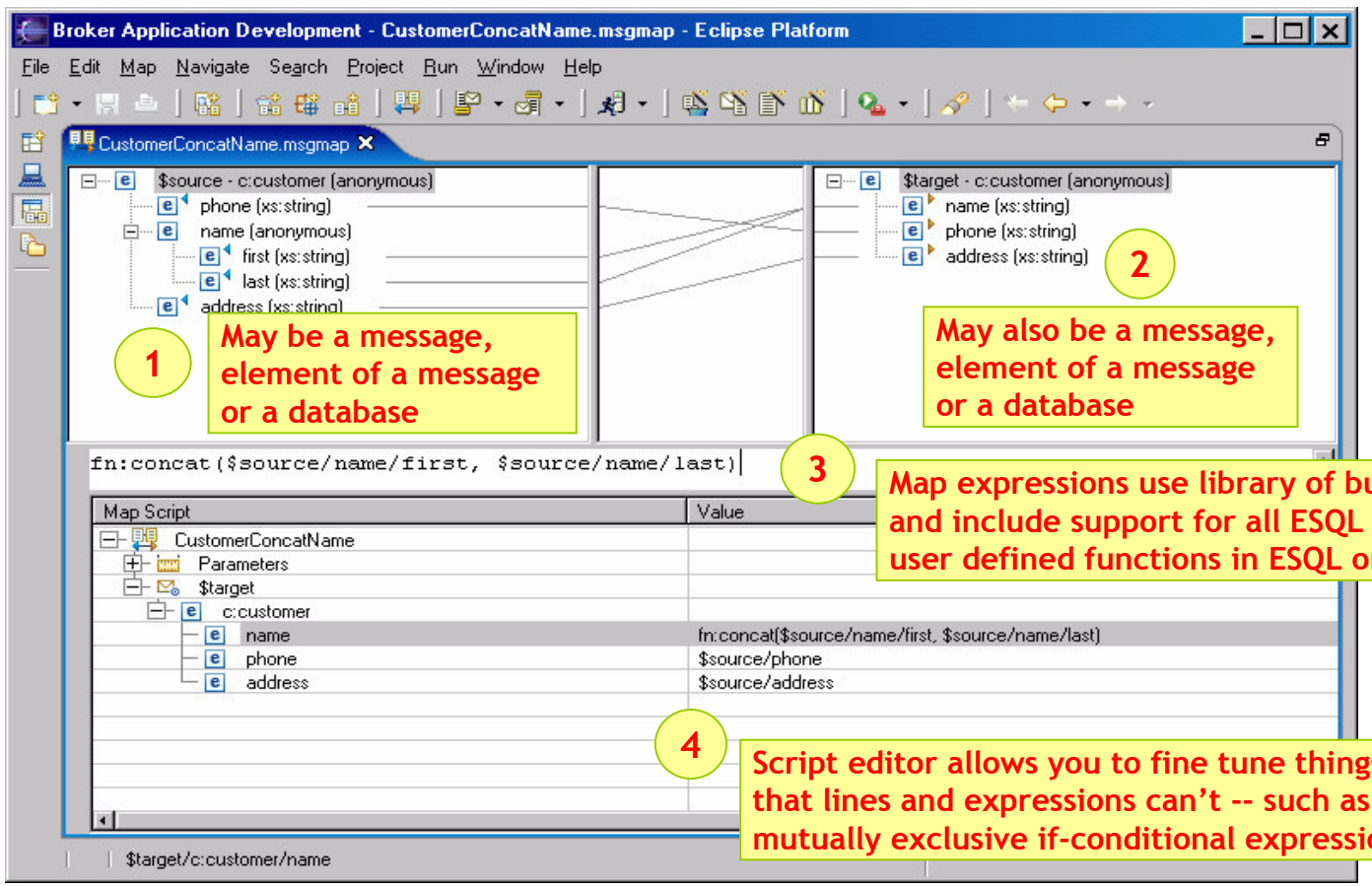
WMBv6 Event Correlation Services

- 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 situation (eg 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 'next generation' Message\Database Mapping

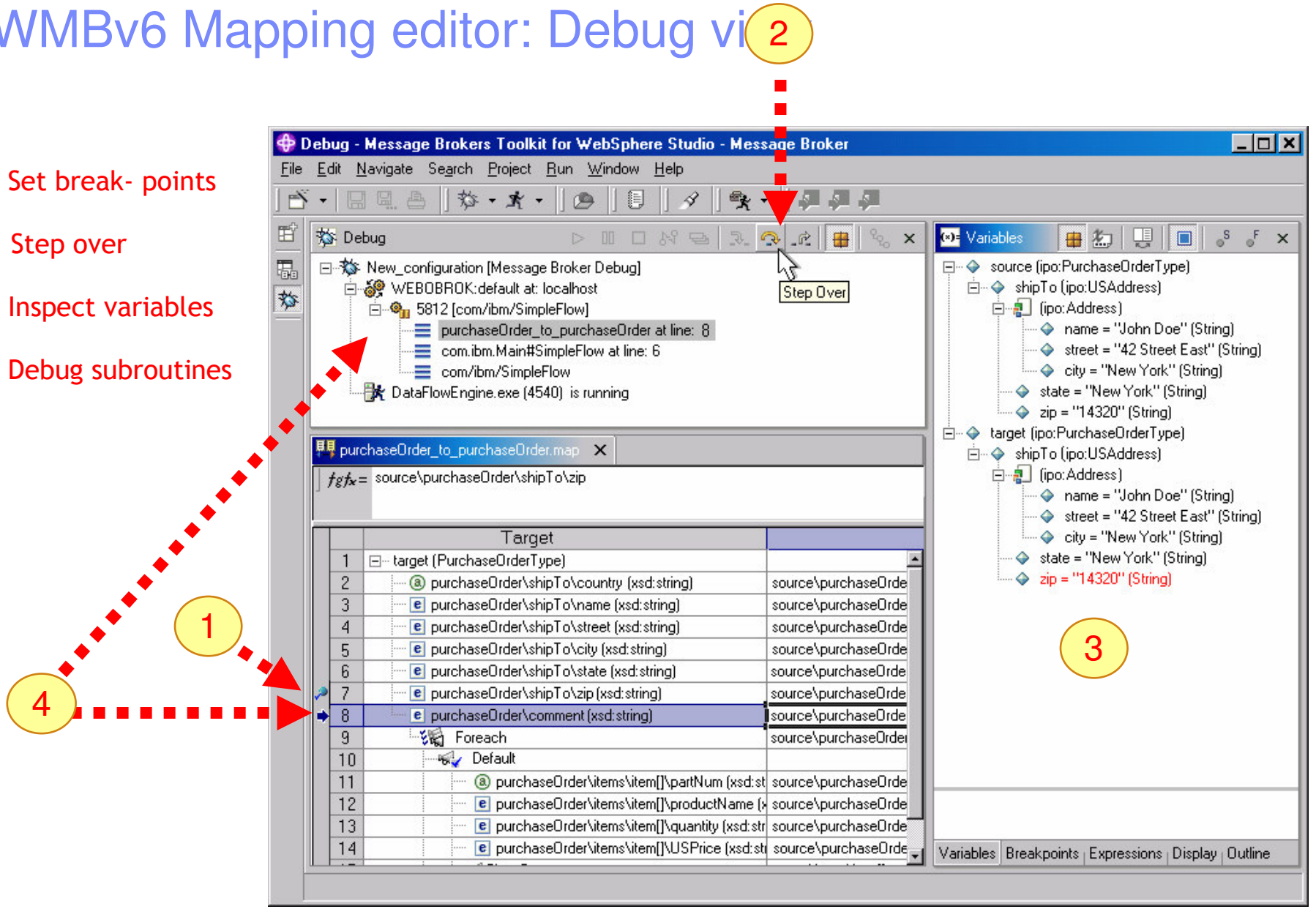
- Adopt a spreadsheet model for creating transformations
- the user concentrates on the structural transformations…
- …not the execution logic



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

WMBv6 Mapping editor: Debug vi

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

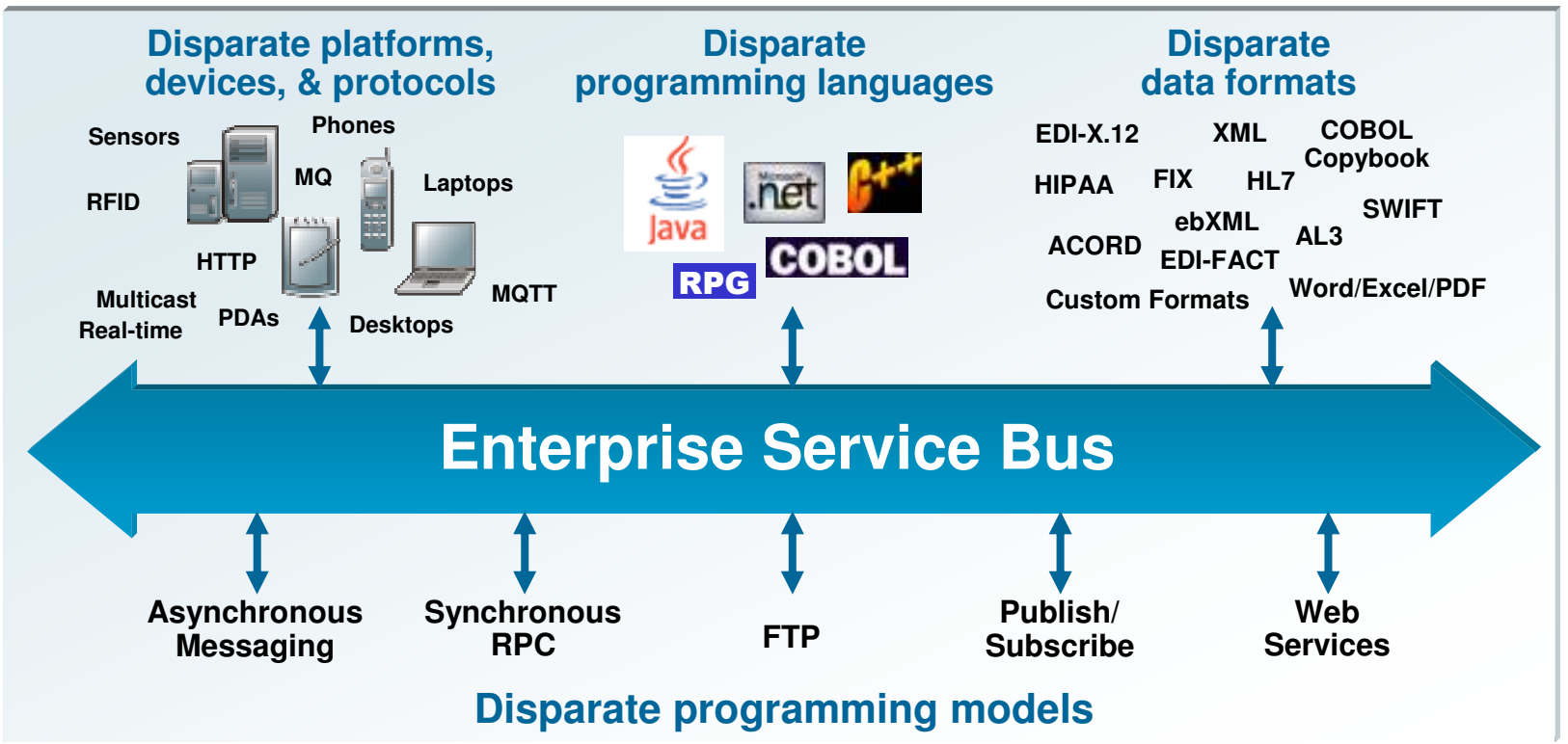


ESB => Ability to Connect All Assets

A "federated" connectivity architecture enabling applications running

- **on *different platforms, devices, and protocols***
- **or which are written in *different programming languages***
- **or which use *different data representations***
- **or which communicate using *different programming models***

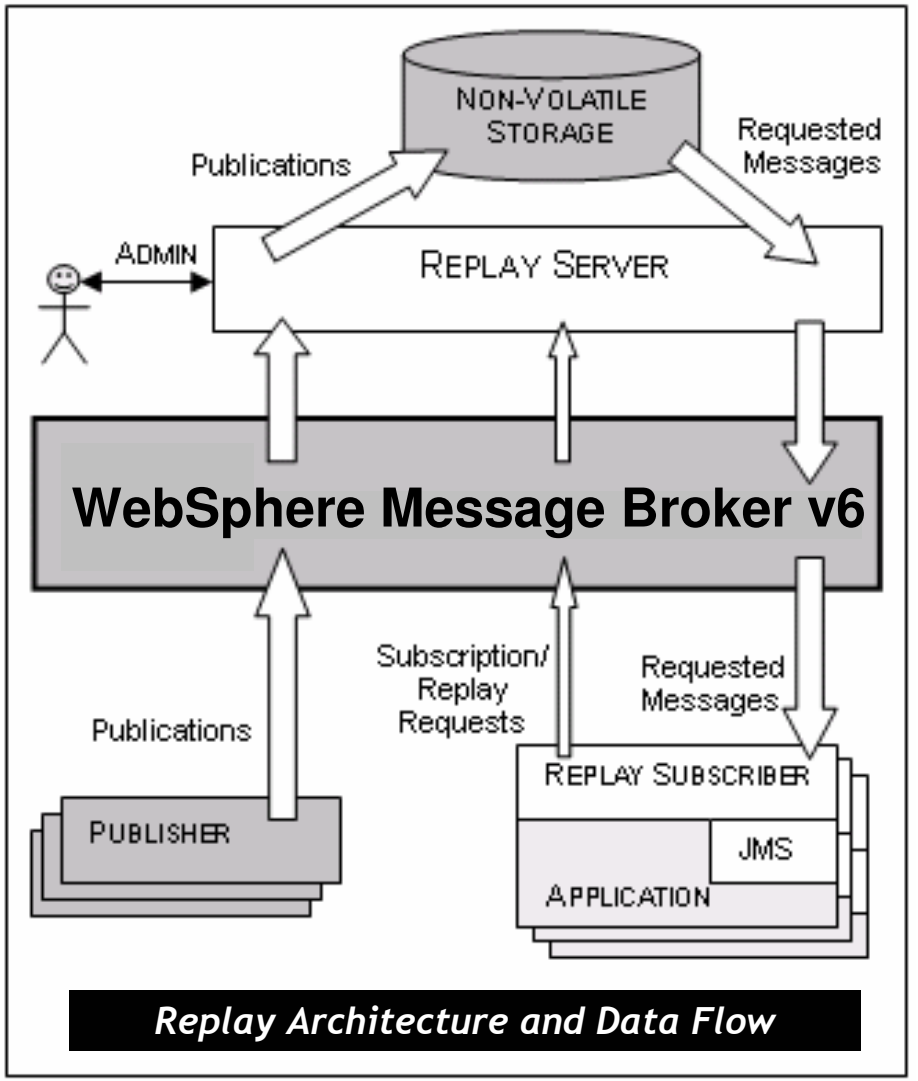
to talk to any point *with no disruption to existing applications or interfaces*



Click here to return

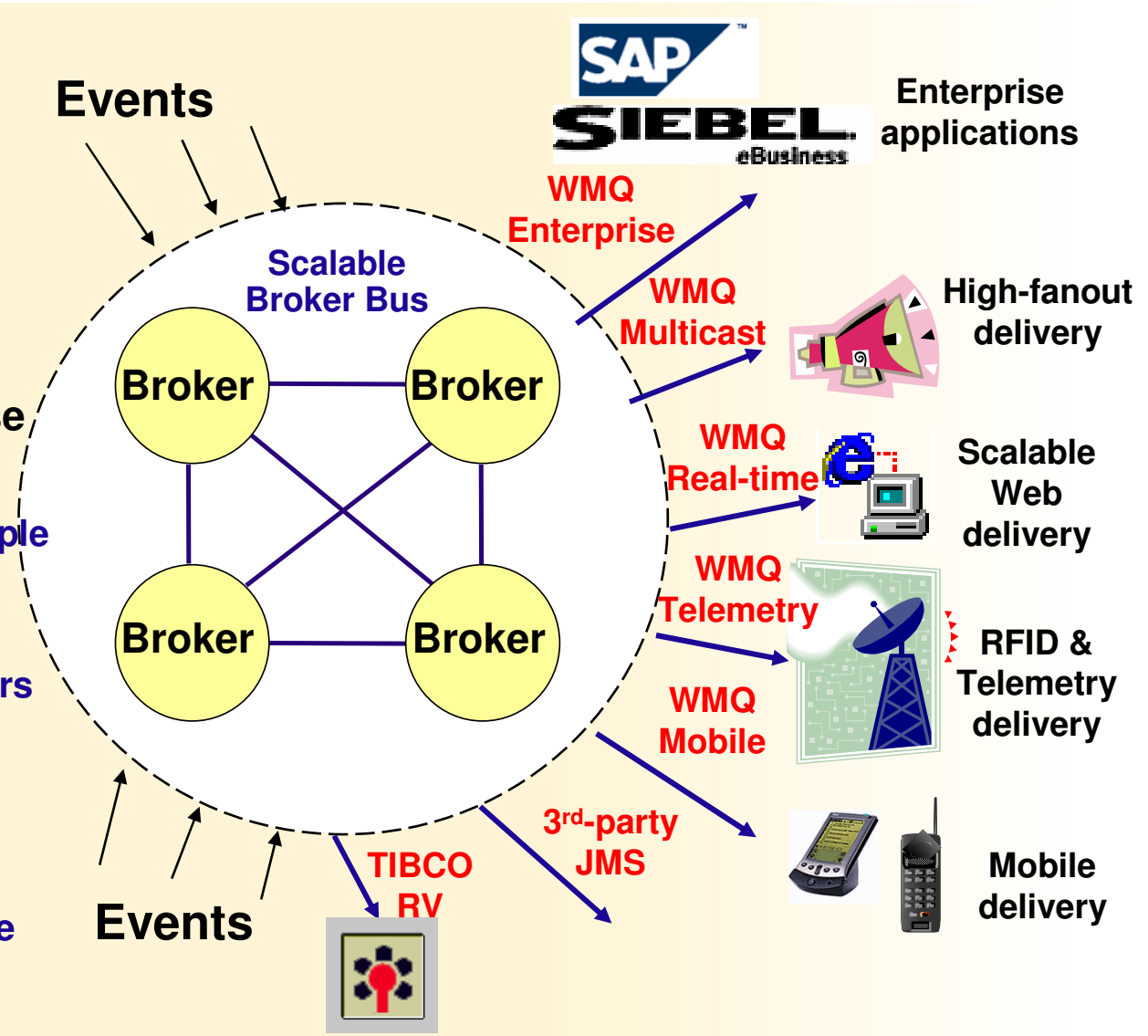
WMBv6 Message Resender / Replayer

- Records all events over a period
- Provides capability to replay previously-published messages
  - Start / end sequence numbers
  - Start / end dates
  - Near-live catch up
- High performance / low latency
  - Multiple persistence options (DB2, flat-file, …)
- Can be used with Complex Event Processing
- Replay Server component contains: Persistor, Replayer, Pruner & Persistence Service.



WMBv6 -the Scalable Enterprise Event Bus

- **Multi-transport switching**
  - Multiple transports each providing unique qualities of delivery
  - Applications emit on any one transport and receive on any other.
- **Scalable distributed enterprise bus**
  - Harnesses the power of multiple servers
  - Messages published to one broker delivered to subscribers on any other broker.
  - Central administration.
- **Complex event processing**
  - Situations identified within the bus.



WebSphere Message Broker v6 – Competitive Differentiators (1)

Feature	Function	Benefit
1. Rich high-performance options *(e.g., up to 800,000 messages/second in multicast speed tests)*	Provides significantly higher performance than other EAI platforms	Very high speed processing
2. Rich scaling options *(multiple threads, multiple flows, multiple execution groups, multiple brokers)*	Scales much higher than other EAI platforms	Implemented in some of the world's largest deployments
3. End-to-end transactions *(exploits the transaction coordinator of WebSphere MQ)*	Enables the execution of complex message flows as a single unit of work	No risk of lost transactions
4. ESB transactionality even for 3rd-party JMS messaging systems *(e.g., TIBCO EMS, Sonic MQ, etc.)*	Provides single unit of work capabilities that other vendors don't even provide for themselves.	Brings transactional assurance to 3rd-party environments.

WebSphere Message Broker v6 – Competitive Differentiators (2)

Feature	Function	Benefit
5. Any-to-any transformation *(not just XML-to-XML)*	Avoids the processing overheads of other ESBs that mandate having to go to intermediate (XML) formats	Performance; ease of implementation
6. WebSphere MQ exploitation	Best EAI environment when using WebSphere MQ	Single technology
7. Hot deployment	Execute new message flows without bringing down the server	24/7 operations; avoids having to deploy new servers
8. Complex event processing within standard message flows	Enables identification of very complex events at very high-speeds	Enables a new class of applications that can provide significant competitive advantage

WebSphere Message Broker v6 – Competitive Differentiators (3)

Feature	Function	Benefit
9. Eclipse based tooling	Open pluggable tooling infrastructure – same as all other IBM middleware	Reduces time, effort, and cost of administration
10. Rich zSeries options *(including direct CICS and VSAM connectivity, exploitation of zSeries MQ shared queues, and a zSeries version)*	Enables your zSeries system to be used for rich EAI.	Best in class continuous availability system
11. Built in telemetry device (MQTT) and mobile device (MQe) transports	Connects sensors and devices to business systems	Enables companies to execute predictive (rather than reactive) business strategies
12. DataStage TX Extender *(chargeable plug-in)*	Runs existing DataStage TX complex transformations directly within a message flow	Runs existing TX maps; Greatly simplifies the processing of complex data (both ease of use and speed)

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High Availability Concepts

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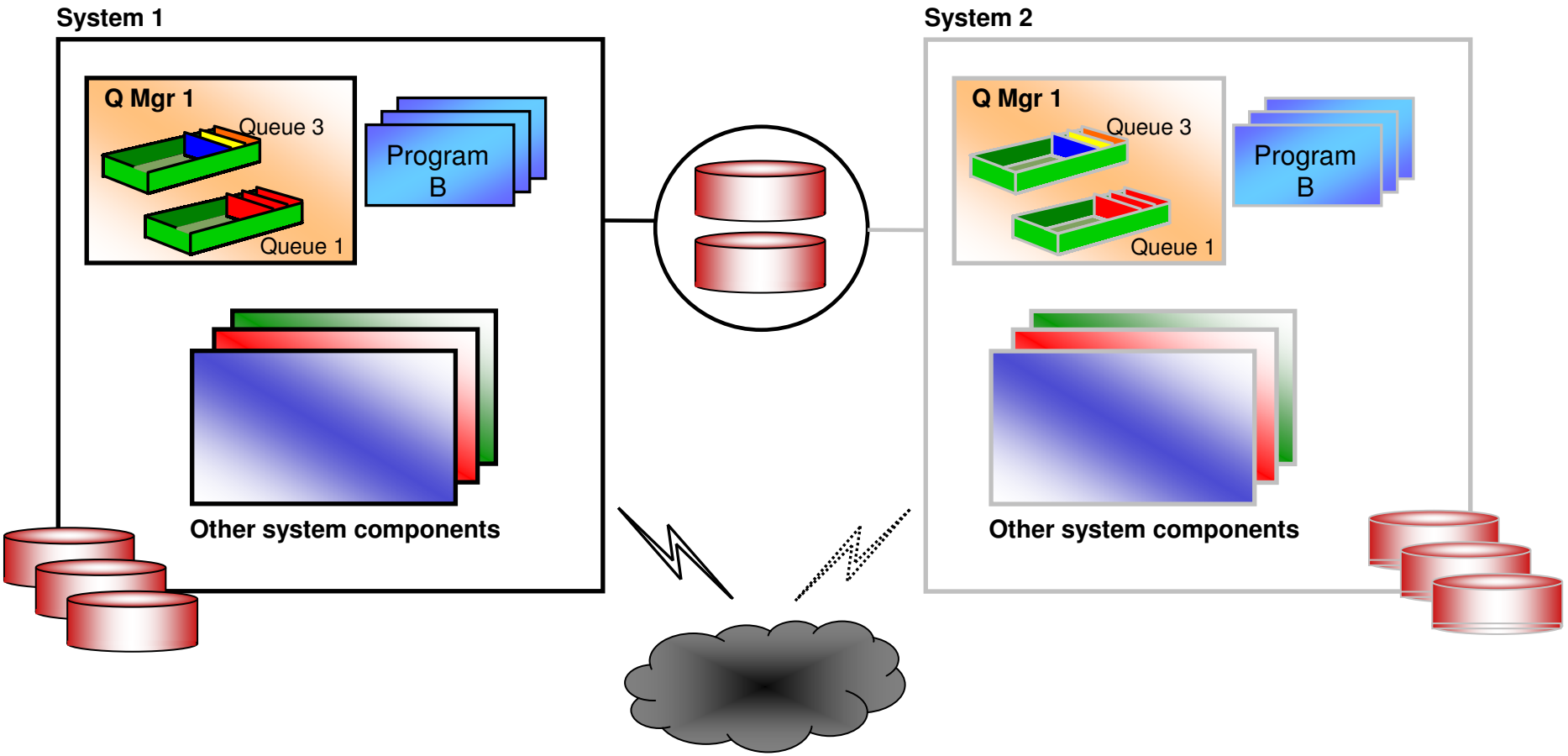
WMBv6 -Operational Capabilities

- High Performance
- Scalability
- High Availability
- Load Balancing
- Fail-over
- Security
- Qualities Of Service choice

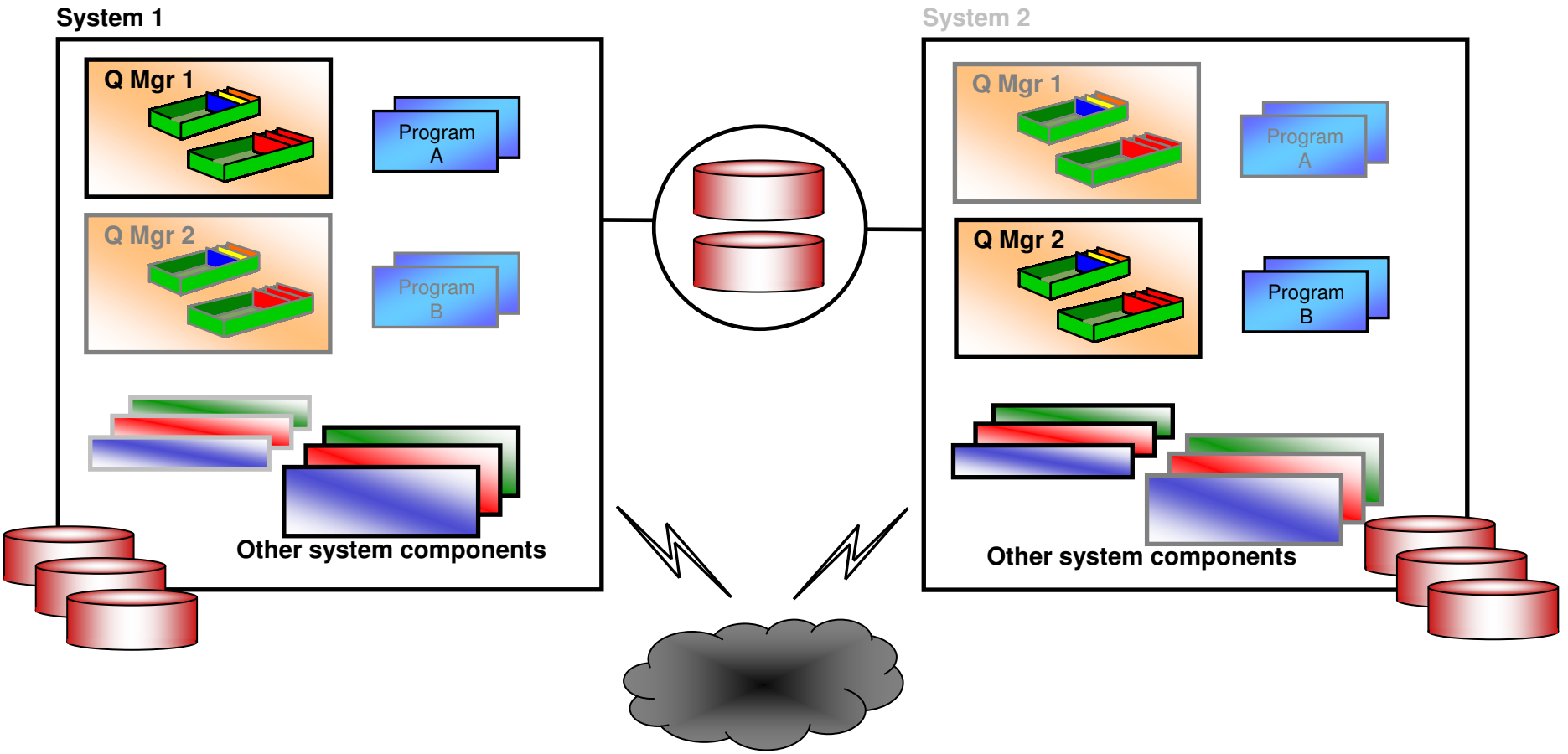
WMB\WMQ and High Availability (Active:Passive)



High availability implemented by the operating environment

- Active:Passive implementation model

WMB\WMQ and High Availability… (Active:Active)



High availability implemented by the operating environment

- Active:Active implementation model
- No redundant/inactive resources

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Challenges brought about by XML and SOA

Extensive use of XML brings new challenges:

- **Scalability:**
  - XML is bandwidth, CPU and memory intensive
- **Performance:**
  - Some XML apps literally grind to a halt
- **Security:**
  - Connecting systems never before connected
  - Clear text over HTTP with no inherent security
- **Integration:**
  - Connecting Web services to legacy application
- **Standards:**
  - Are still in flux …
- **Other Challenges:**
  - Financial, Technical, and Organizational challenges

WebSphere DataPower Appliances concepts

IBM DataPower Simplifies, Protects & Accelerates SOA XML implementation challenges

- **Wire speed processing**
  - "…It will appear as if the appliance is not there…"
- **Straightforward configuration, deployment and operation**
- **Support for multiple transports**
  - –TCP/IP, HTTP(S), WebSphere MQ (client), FTP, SMTP, NFS
- **Integration with existing components**
  - –Application Servers, Message Brokers, Security Servers, …
- **Primary data format is XML …**
  - other structured data also supported

WebSphere DataPower Appliances details

XML Accelerator XA35

Wirespeed Appliance Purpose-Built to offload XML Acceleration

- XML \ XSD Parsing
- XML Schema Validation
- XML ←→XML Transformation
- Schema, Stylesheet caching
- MultiStep processing
- XML Path Language (XPath) Content Based Routing
- Extensible Stylesheet Language Transformation (XSLT)
- Typically faster than software solutions

XML Security Gateway XS40

Wirespeed Appliance Purpose-Built to offload SOA Security

All XA35 functions, plus:

- XML and SOAP Firewall
- Data Parse, Filter, Validation
- Digital Signatures, En\Decrypt
- Field Level XML Security
- WS-Security
- XML Web Services Access Control
- Web Services Management
- Service Virtualization
- Integration with ITAM & 3rd party security products / providers

Integration Appliance XI50

Wirespeed Appliance Purpose-Built for Application Integration

All XS40 functions, plus:

- Expands support to non-XML solutions & structured data formats
- Protocol Bridging (MQ Client, HTTP, FTP Client, etc)
- Message Modeling, Enrichment, Message Augmentation
- DataGlue: Any-to-Any Transformation Engine
- Binary or Flat text →XML
- XML → Binary or Flat text
- Binary ←→ Binary
- XML ←→XML

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ESB Patterns

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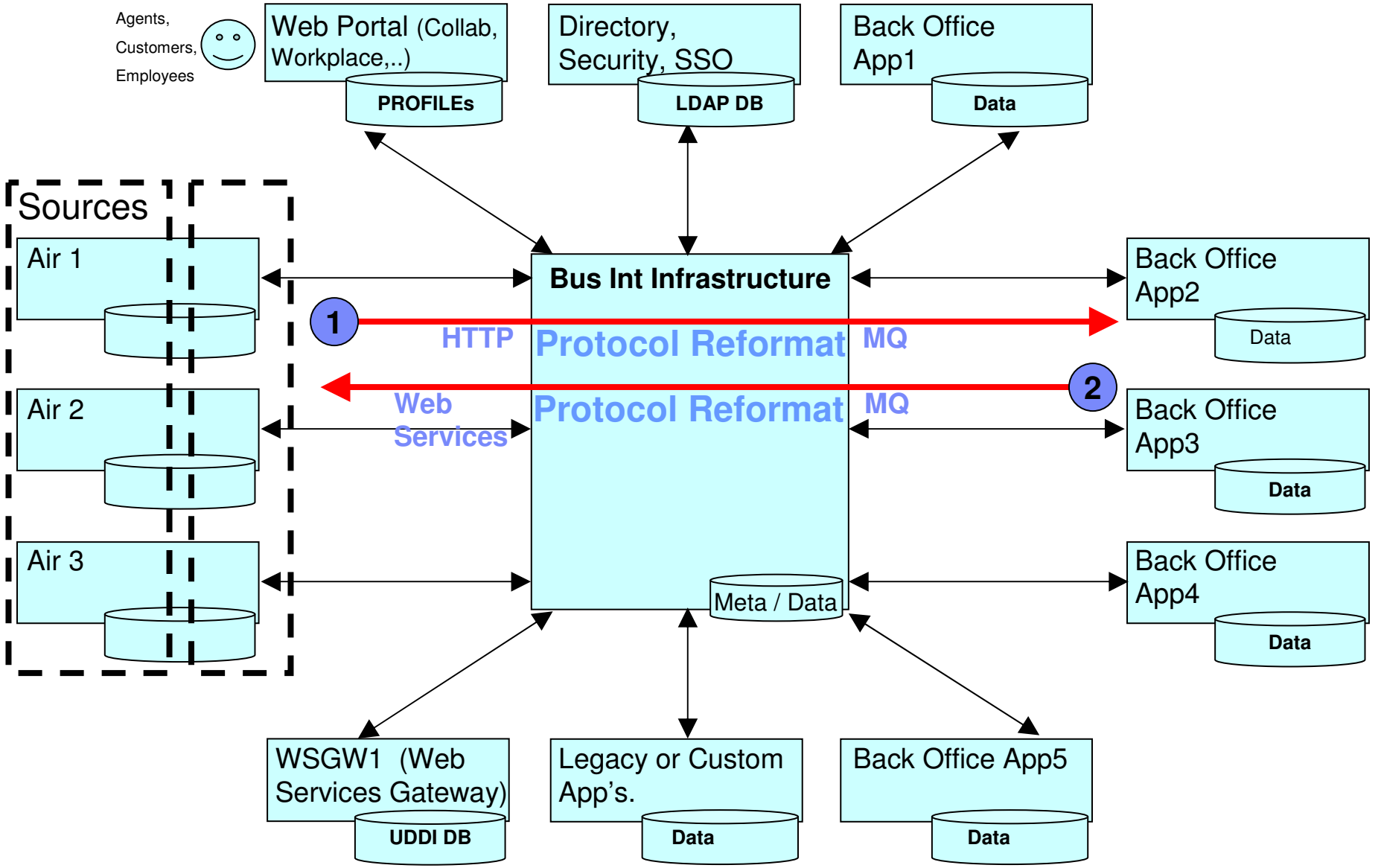
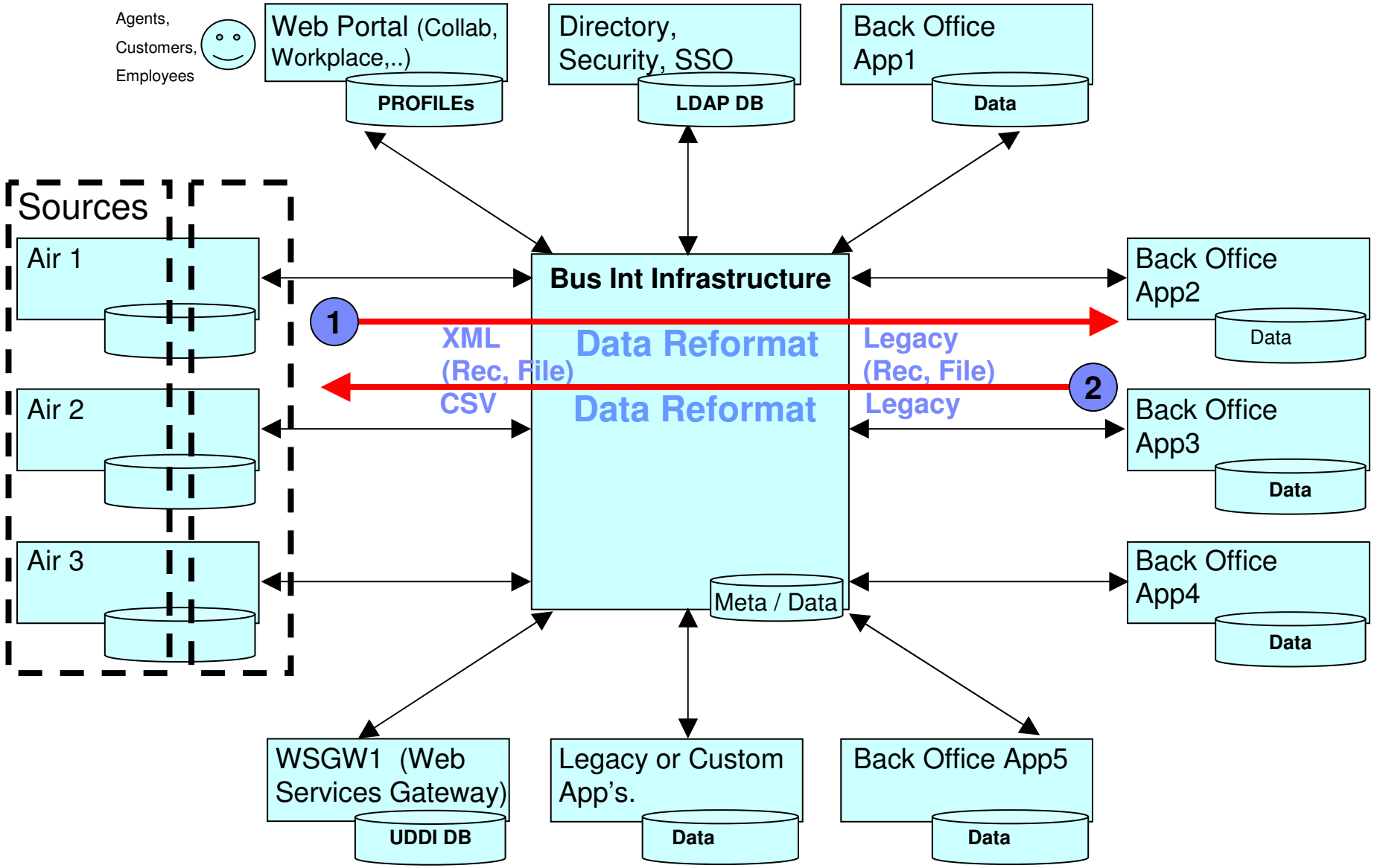
WMBv6 –Supported ESB Patterns (Animated)

- Parse Input
- Render Output
- Switch Protocol
- Re-Platform (Re-CCSID & Re-Encoding)
- Validate Data Structure / Content
- Route Point To Point (to Queue)
- Route Publish/Subscribe (to Topic)
- Route by Content
- Reformat Data (Parse)
- ReShape Data
- Fan-In\Consolidate Data\Segs (over time)
- Gather Data \ Join Data Elements
- Fan-Out\Clone Data
- Split Data \ Slice Data Elements
- Aggregate-Output + Aggregate-Input
- Emit Timer\Interval Event (eg EOD)
- Invoke Web Service
- Wrap Legacy as Web Service
- Enrich Message from Database (Select, Lookup)
- Message to Database (Log, Insert, Update, Delete)
- Commit DB+MQ Transact
- Rollback & Retry DB+MQ Transact
- Complex Event Processing (CEP)

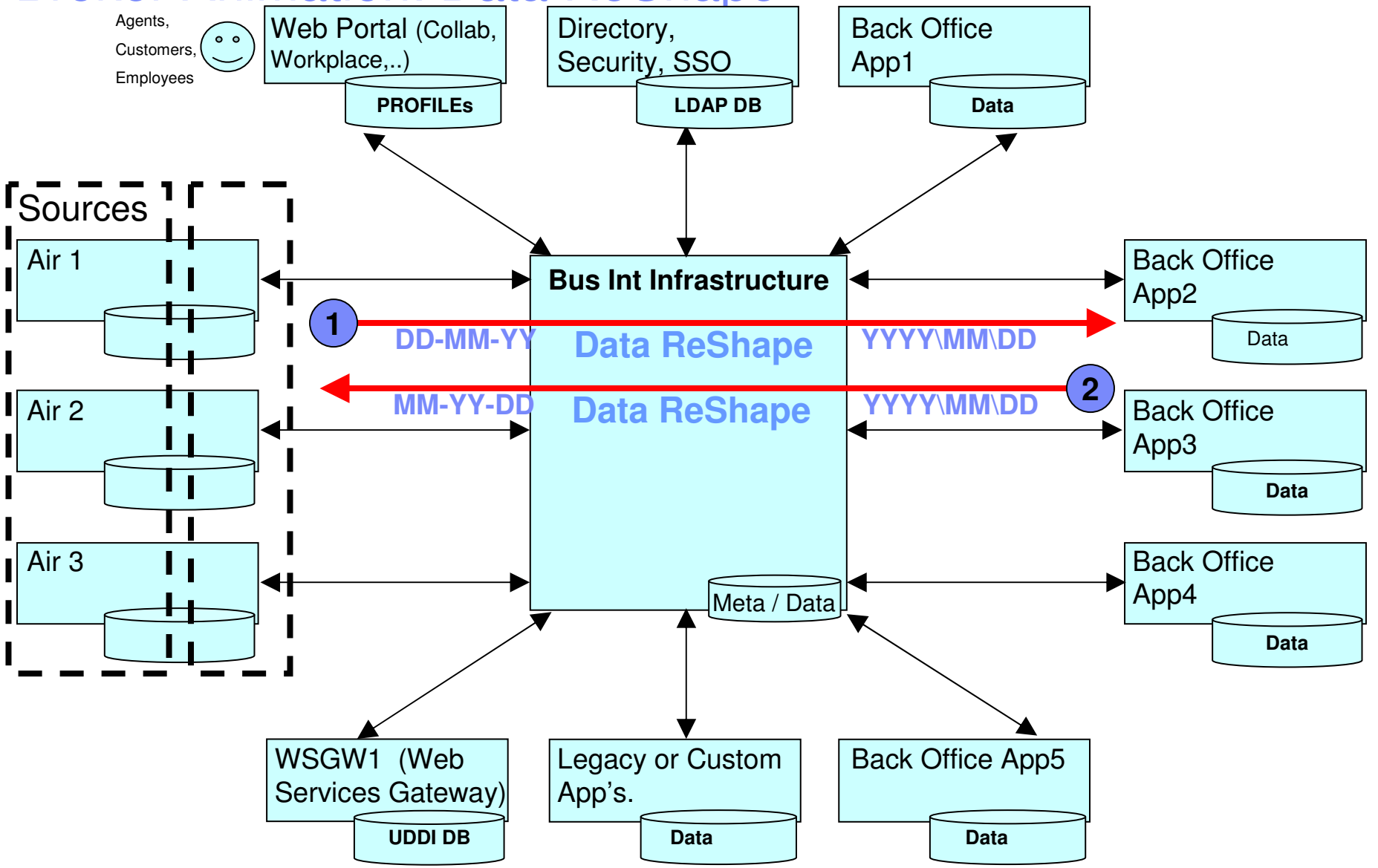
Broker Animation: Protocol Switch



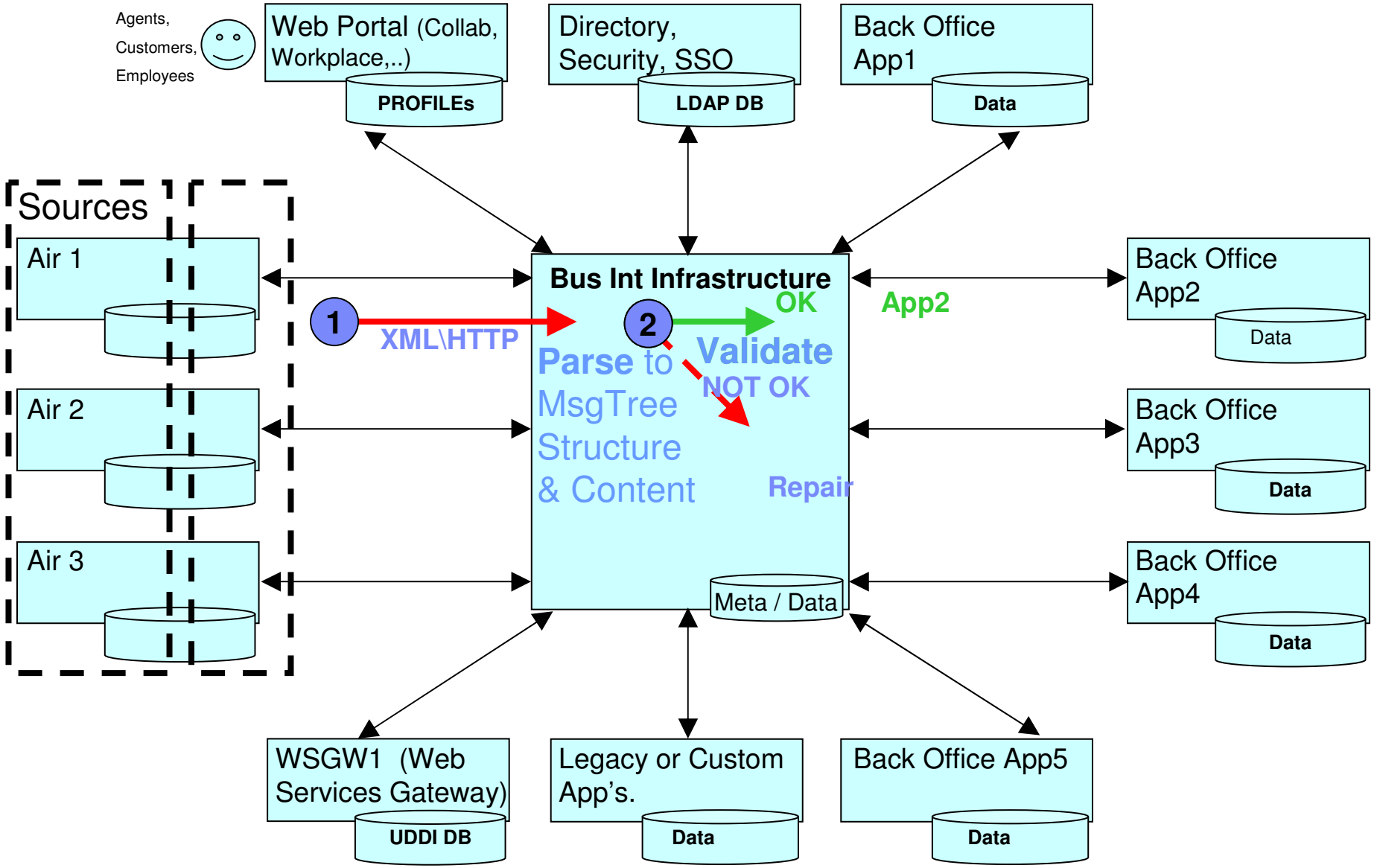
Broker Animation: Data Reformat & Render



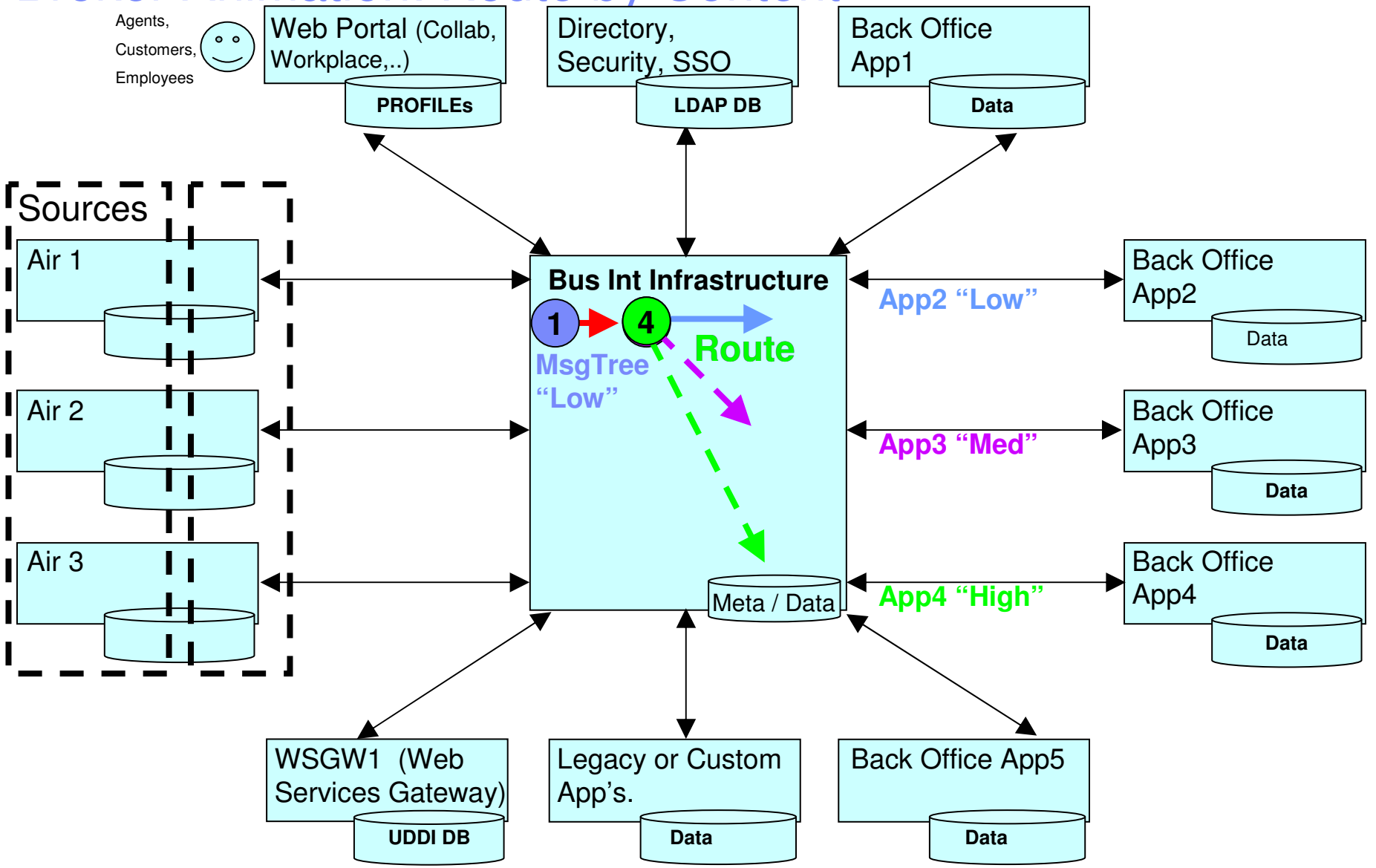
Broker Animation: Data ReShape



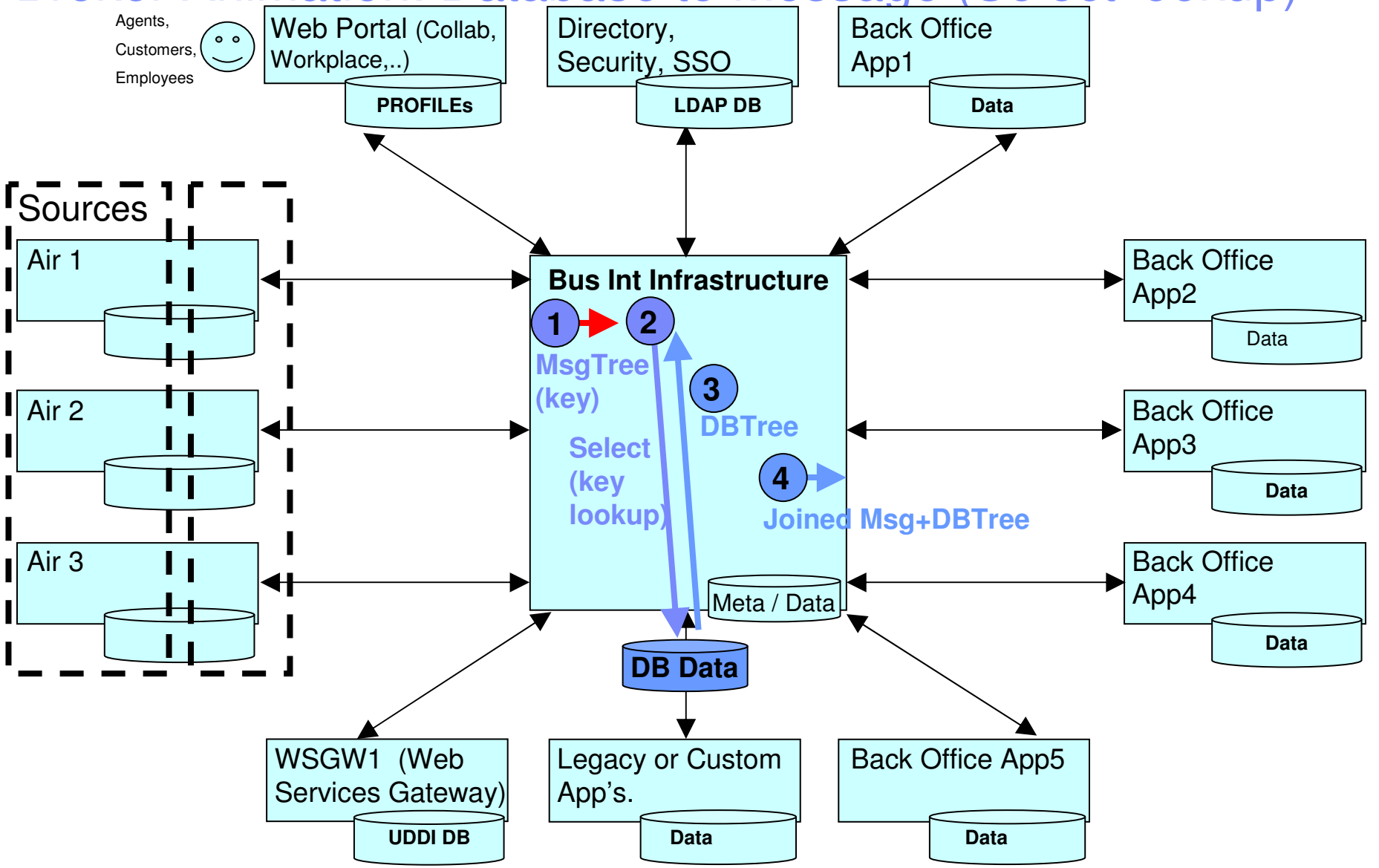
Broker Animation: Parse & Validate Data Structure & Content



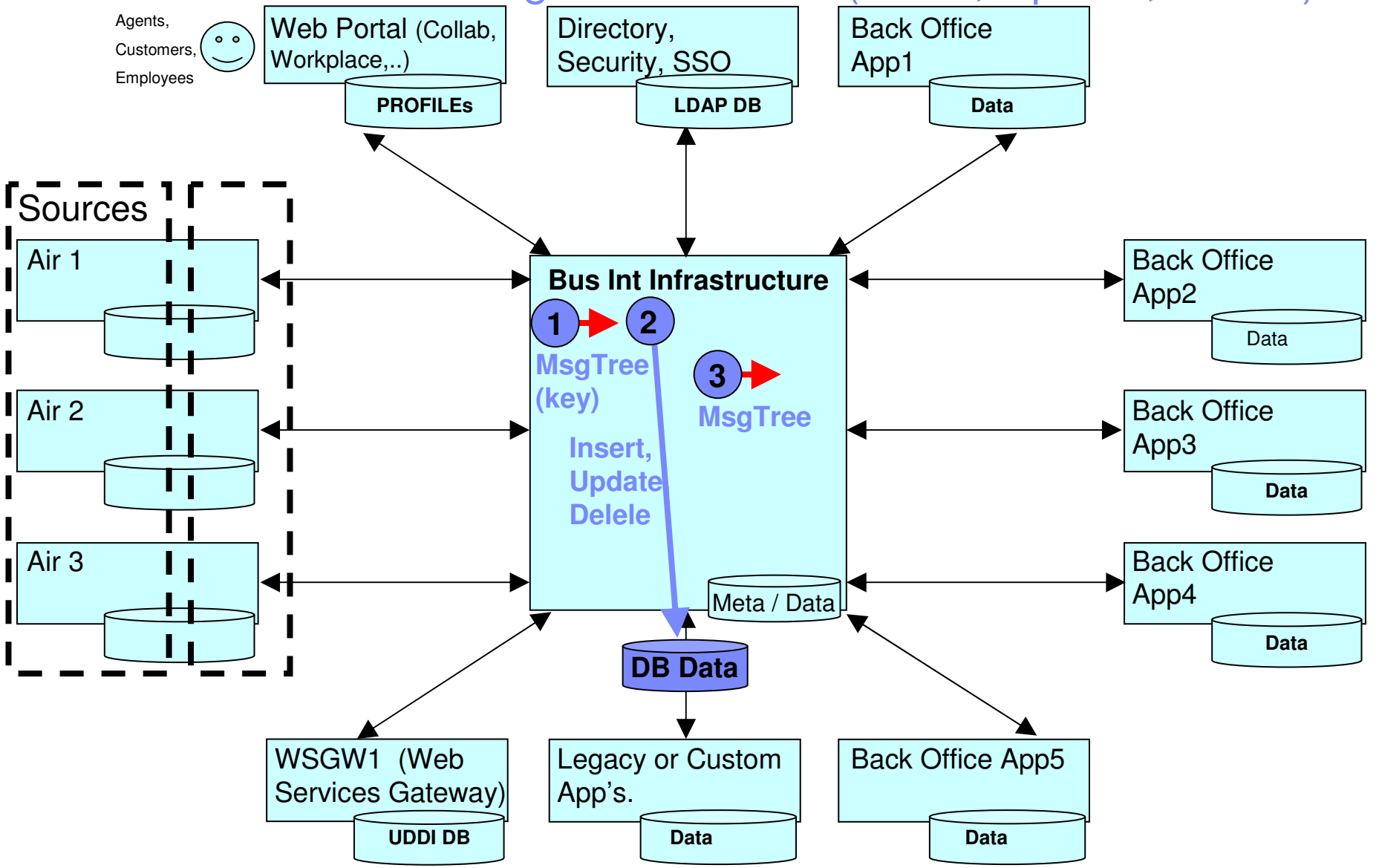
Broker Animation: Route by Content



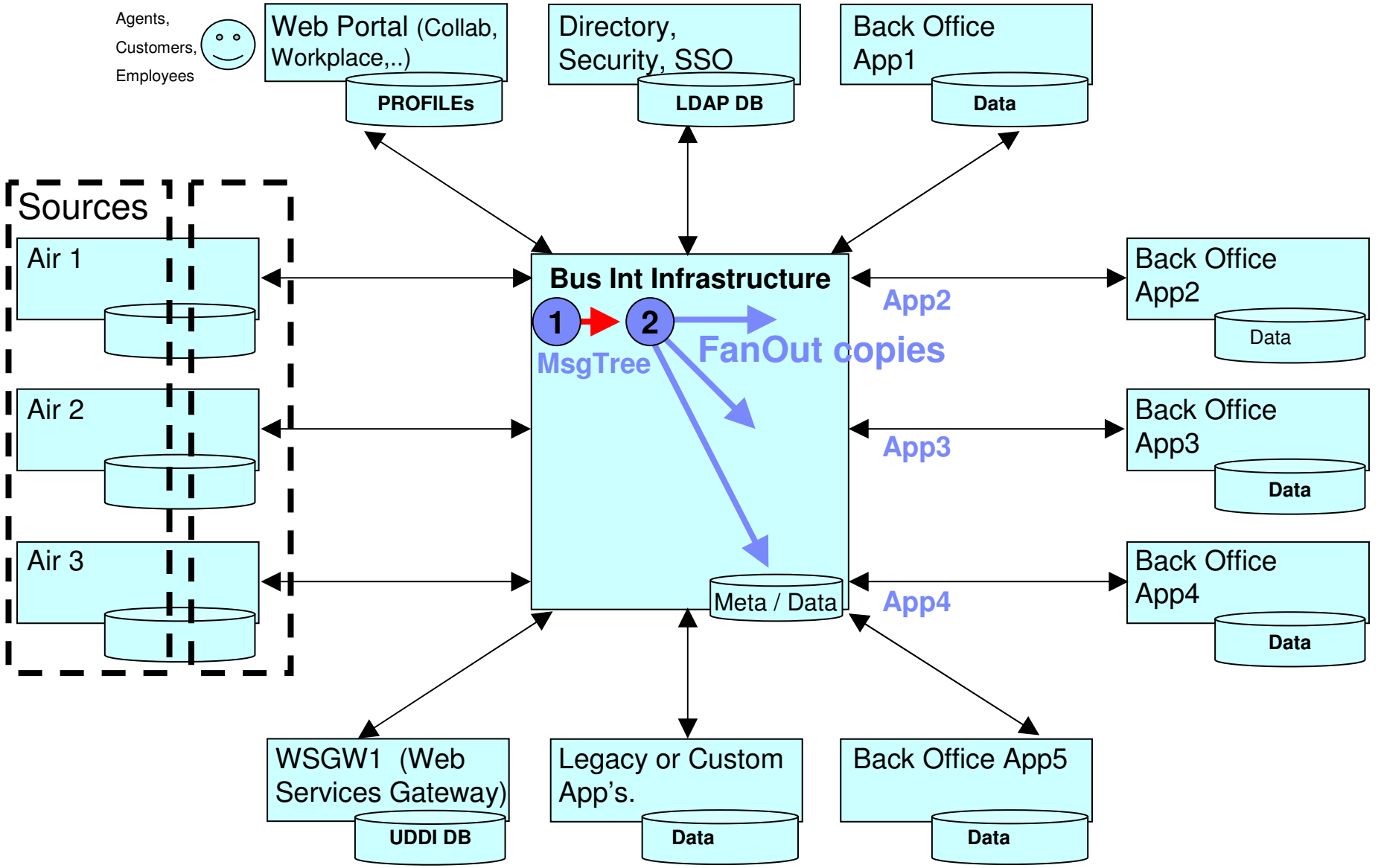
Broker Animation: Database to Message (Select lookup)



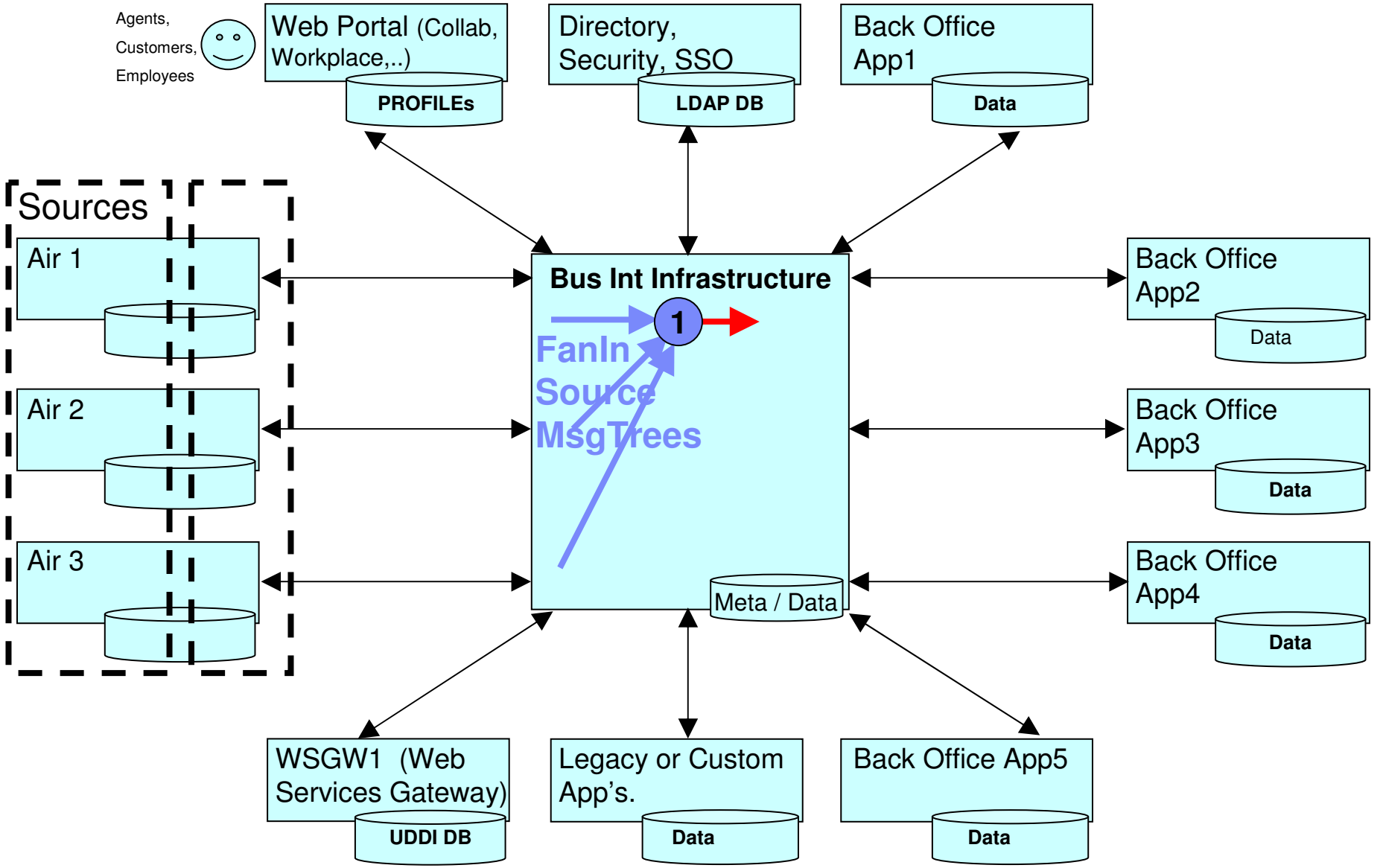
Broker Animation: Message to Database (Insert, Update, Delete)



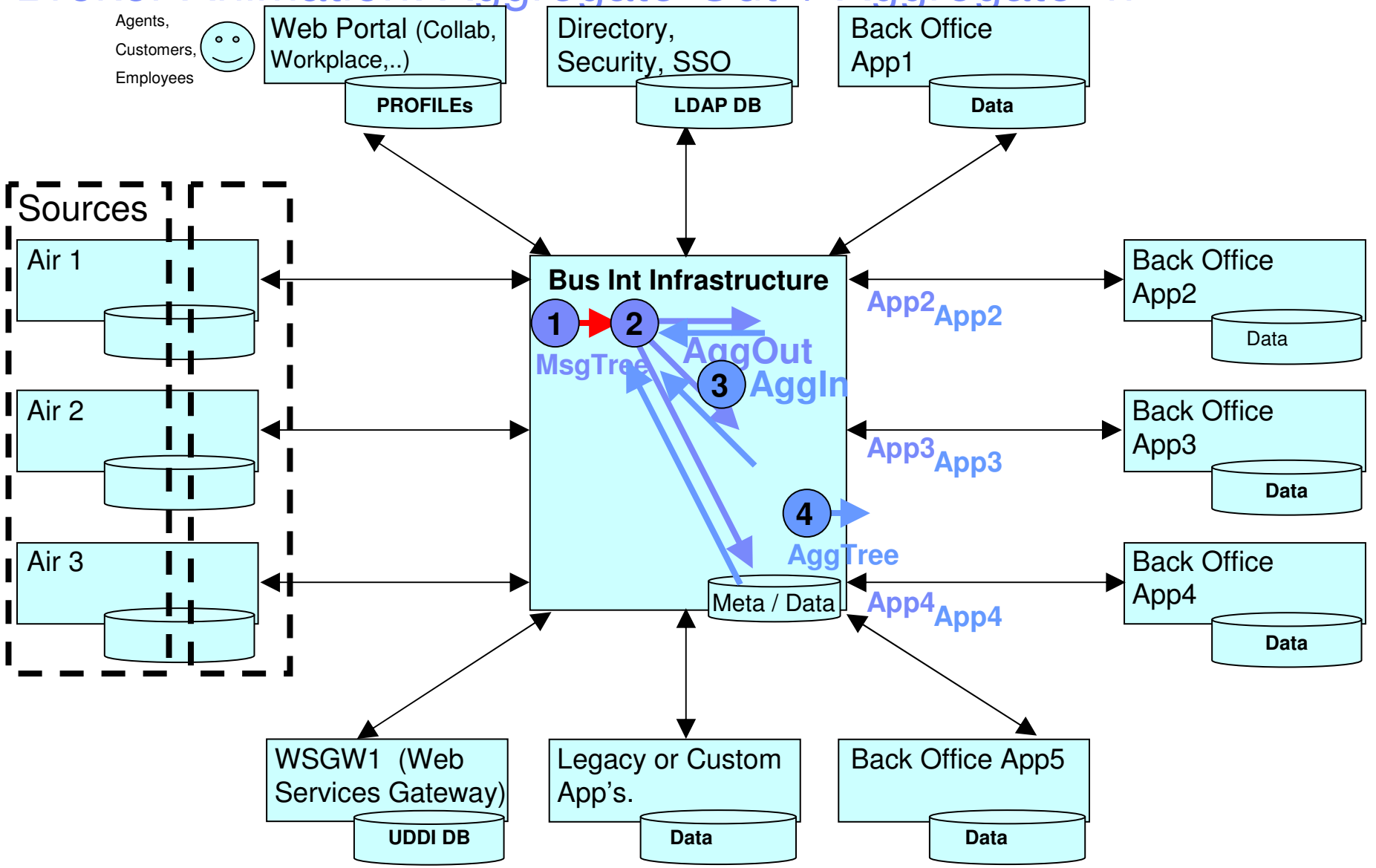
Broker Animation: Fan-Out



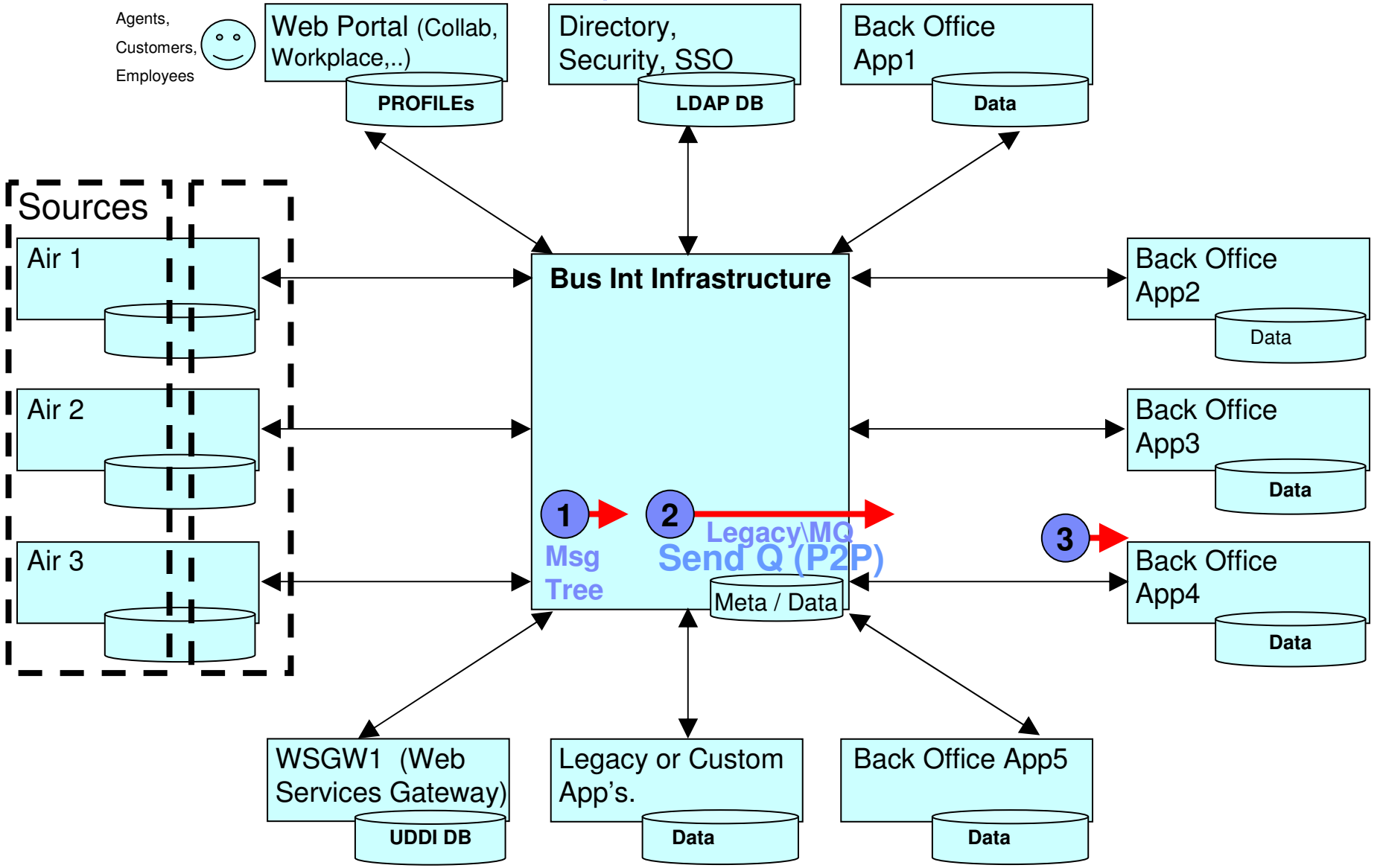
Broker Animation: Fan-In



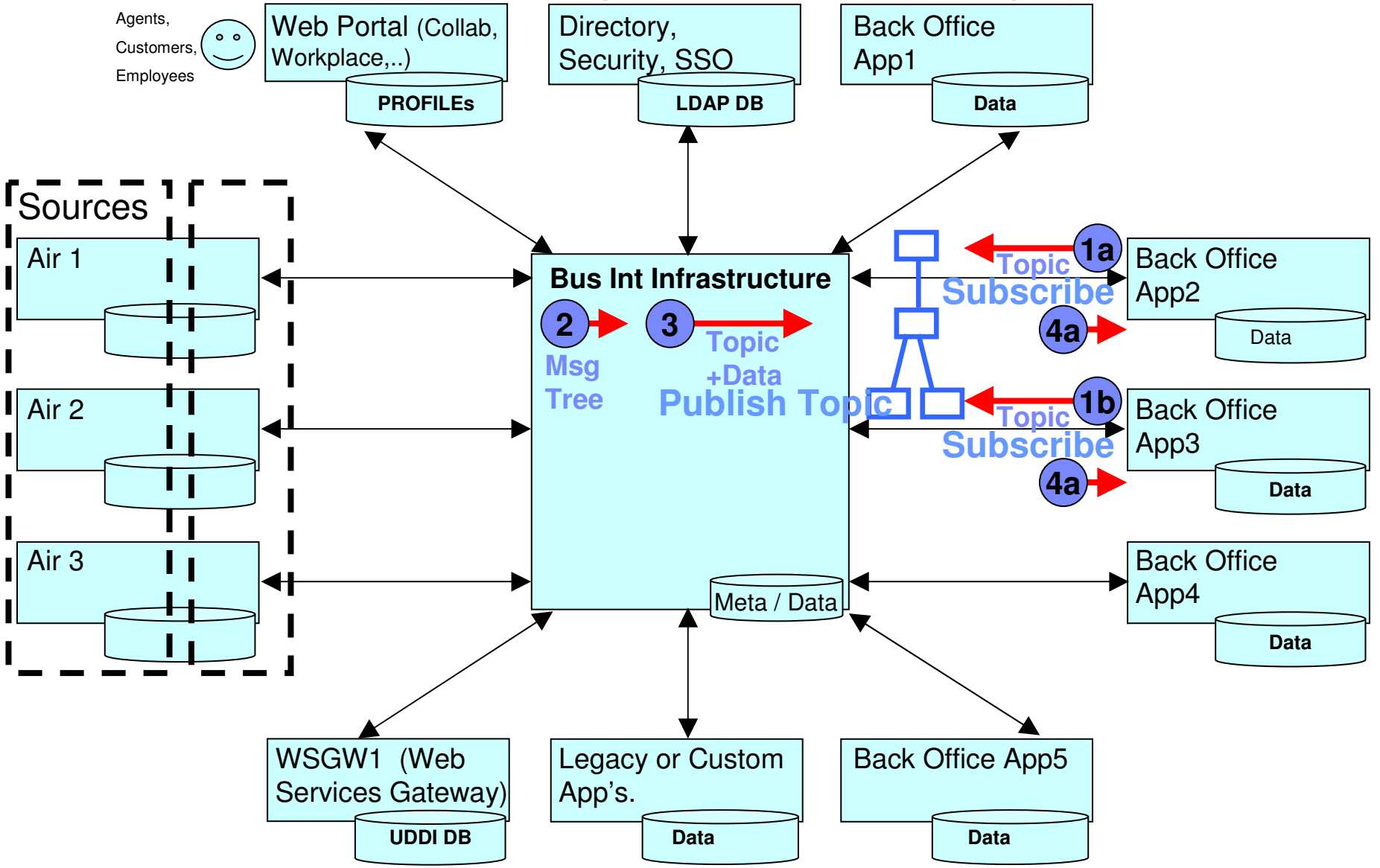
Broker Animation: Aggregate-Out + Aggregate-In



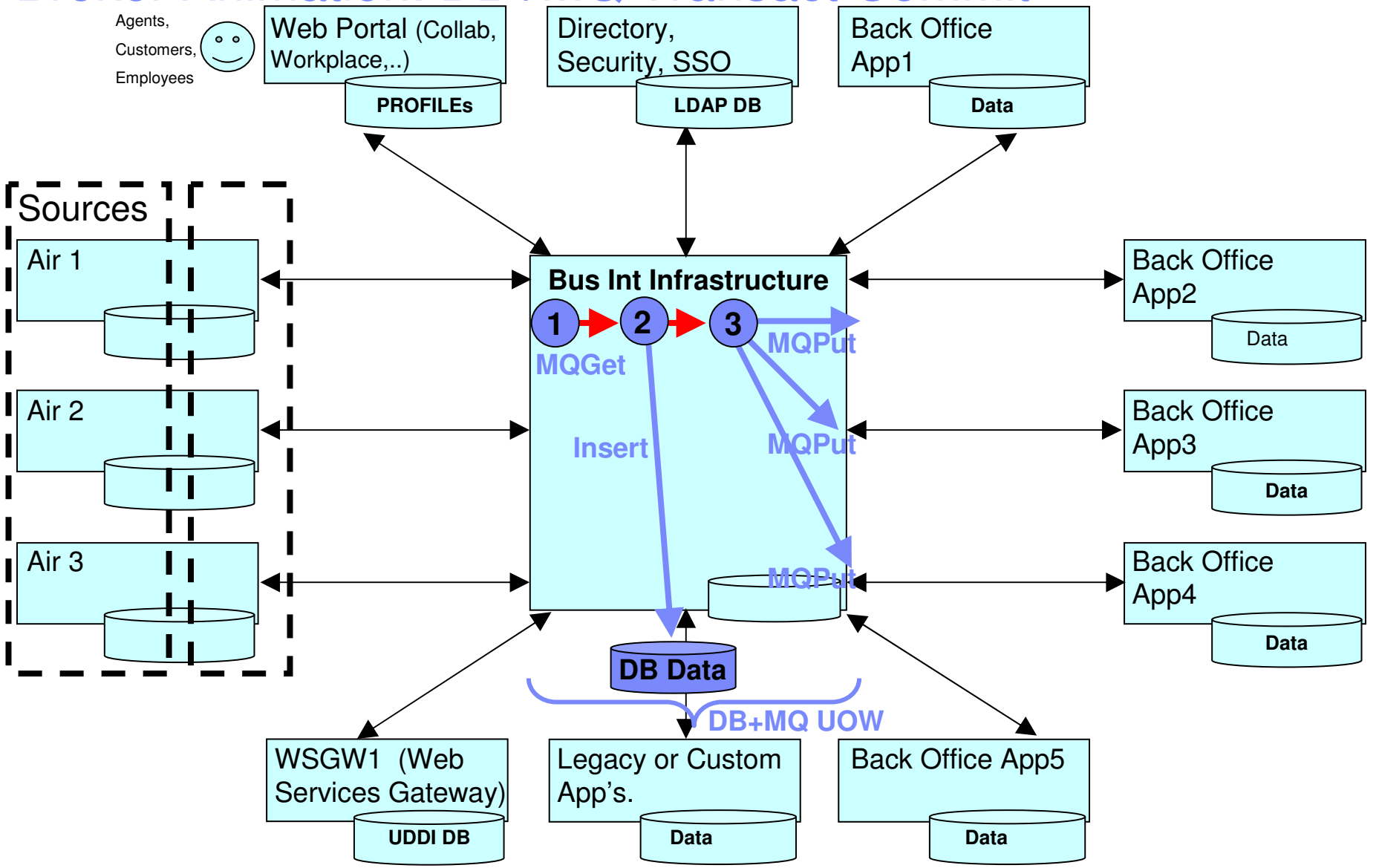
Broker Animation: Render Output & Send (to Q)



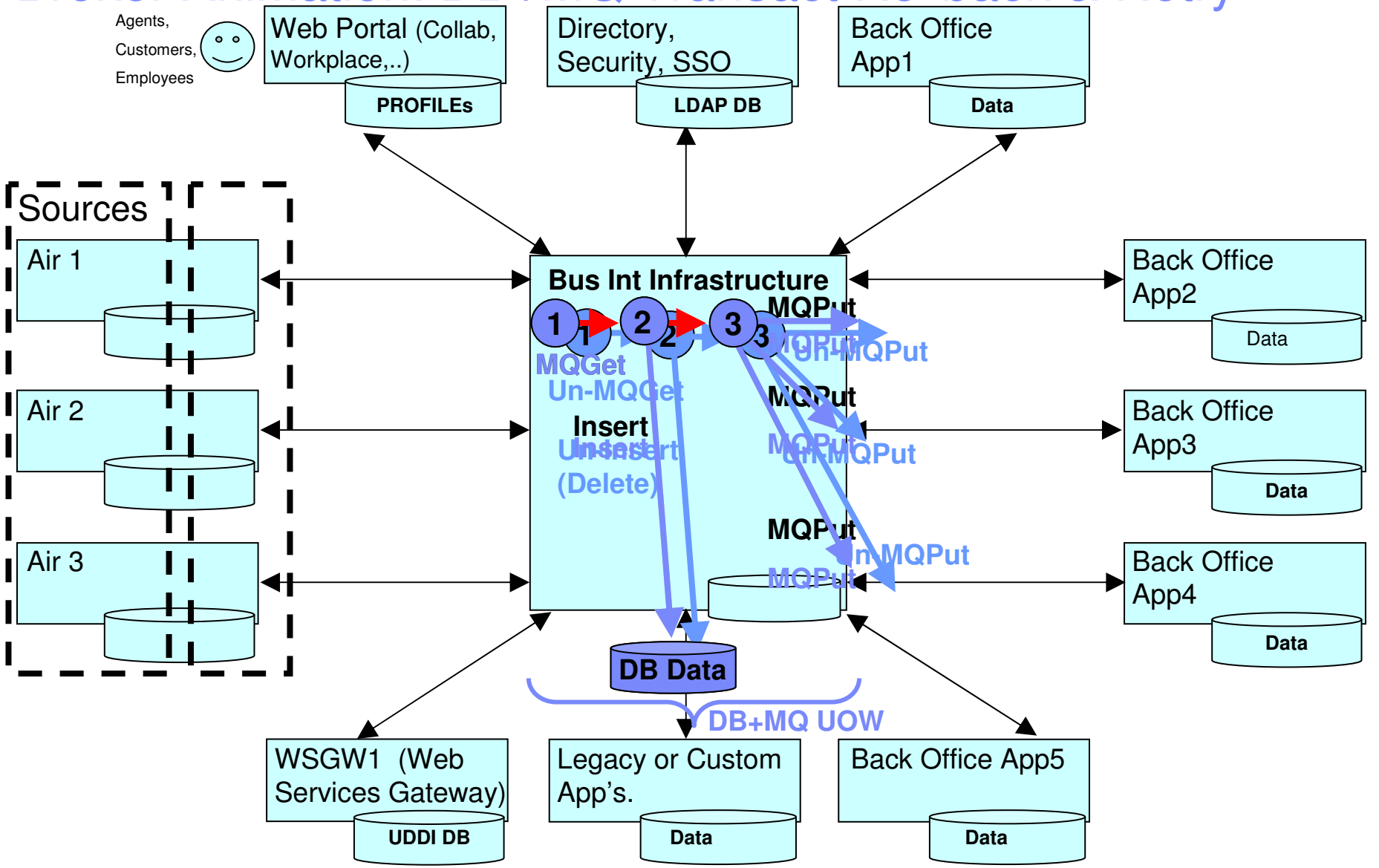
Broker Animation: Render Output & Pub\Sub (to Topic)



Broker Animation: DB+MQ Transact Commit



Broker Animation: DB+MQ Transact Rollback & Retry



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Enterprise Service Bus (ESB), Adapters & Appliances

Summary

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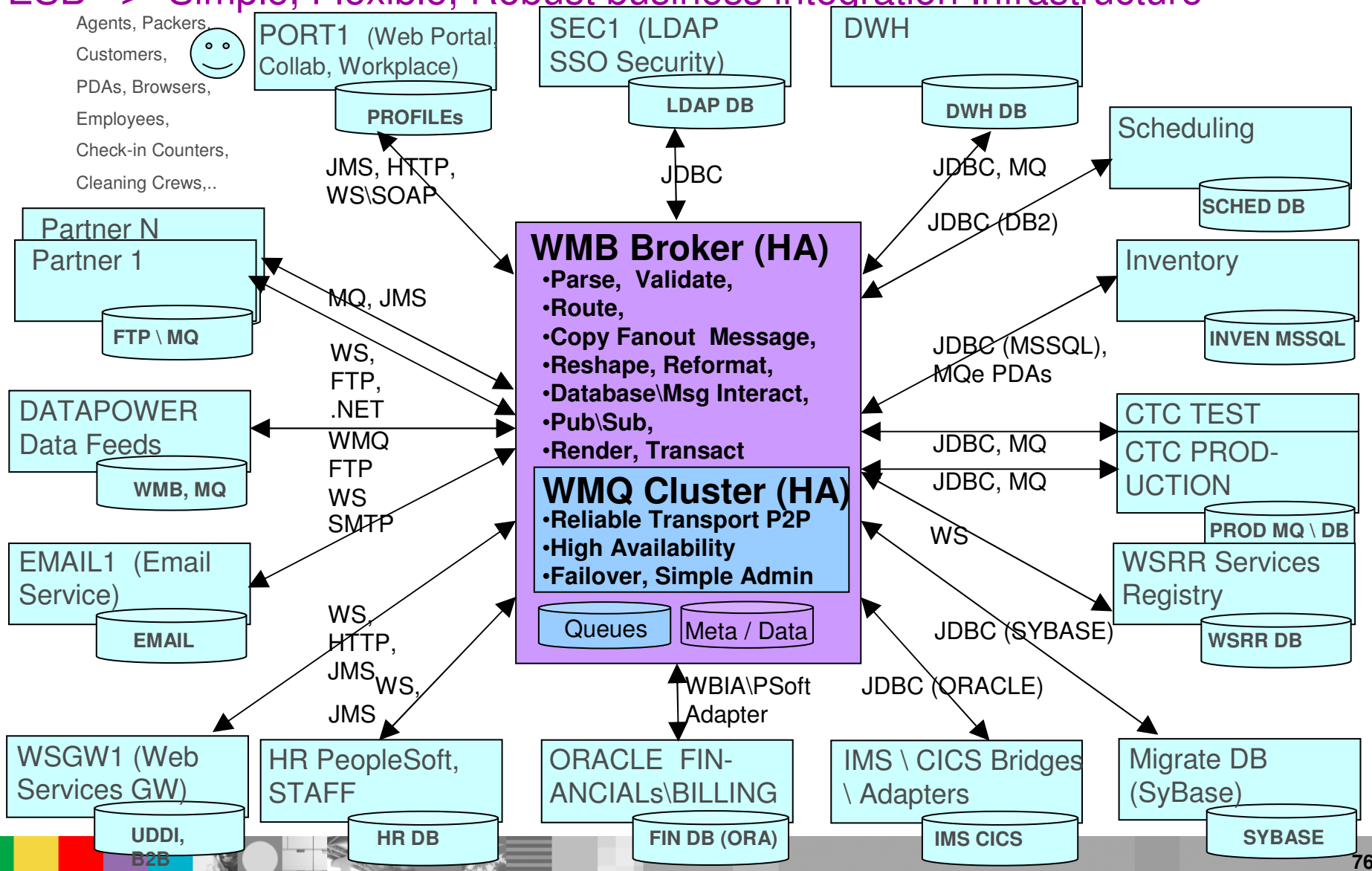
Possible "TO-BE" Additional Spokes

ESB => "Simple, Flexible, Robust business integration Infrastructure"

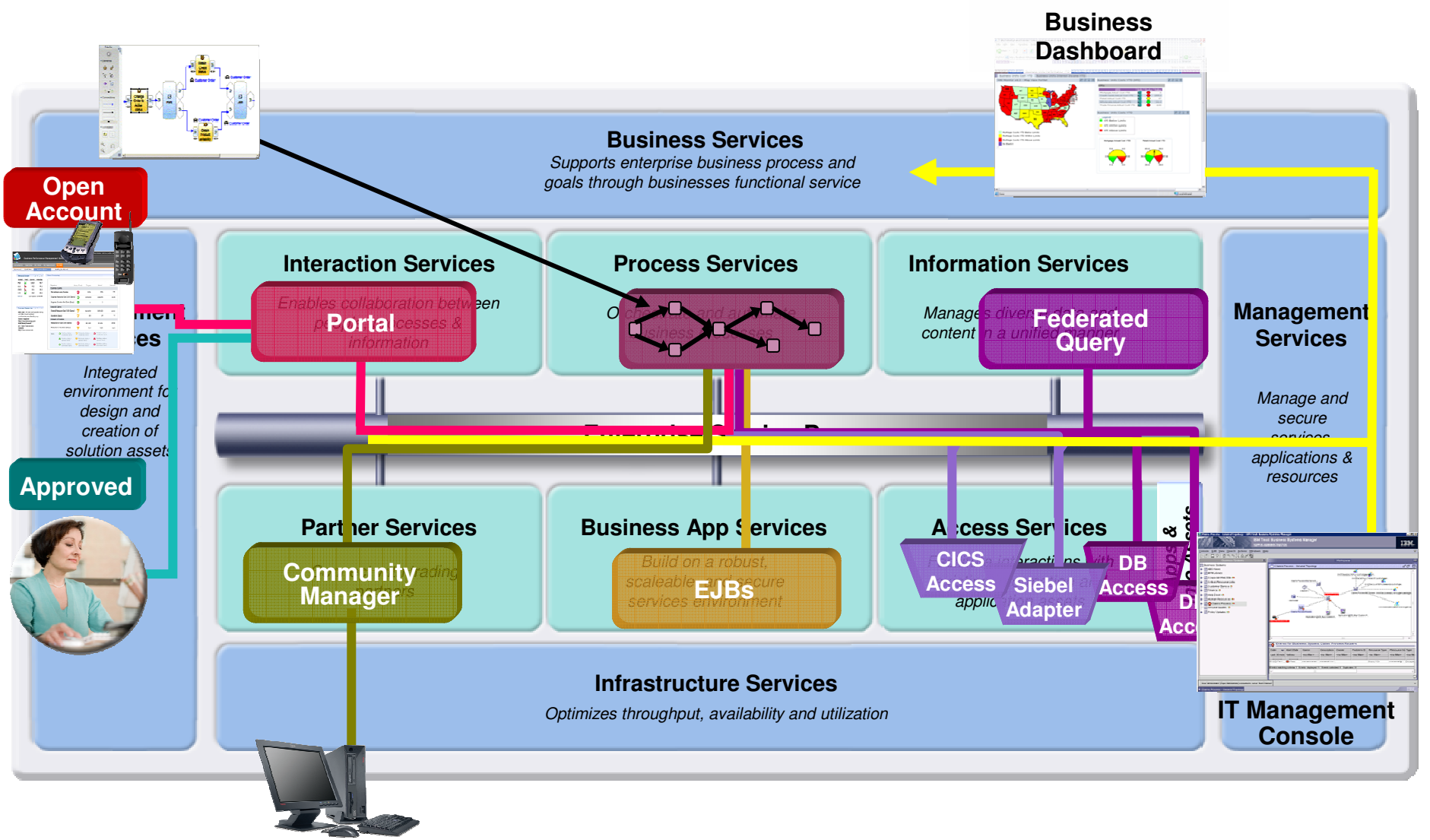


SOA Middleware Solution -Expected Business & IT Benefits

- Standardized\Componentized SOA Integration Architecture with One SOA Service interface to access backend applications or shared data
- A “Flexible, Extendable, Technology-Agnostic, Future-Proof” IT Infrastructure
- Open Standards:
  - J2EE, XML, Web Services (SOAP, WSDL), Mainframe & Legacy Transports
- Improved Agility, Responsiveness, and “On-Demand” Business Efficiencies
- Minimized Cycle-Times for Changes and Reduced Time to Value
- Higher Reuse through composite application creation
- Reduced Costs and Low Total Cost of Ownership
- Timely access to Processes, and High-Quality Data with fewer errors
- Improved Customer Service
- Enhanced Ease Of Use and Productivity
- Extended Application value
- Simpler & Stronger Security (LDAP-based)
- Higher System Availability, Scalability & Throughput, with Fast Response Time
- Robust Middleware from Proven Market Leader

Separation of Concerns

The SOA Reference Architecture in Action



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[WMB Optional Demo]

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Appendixes

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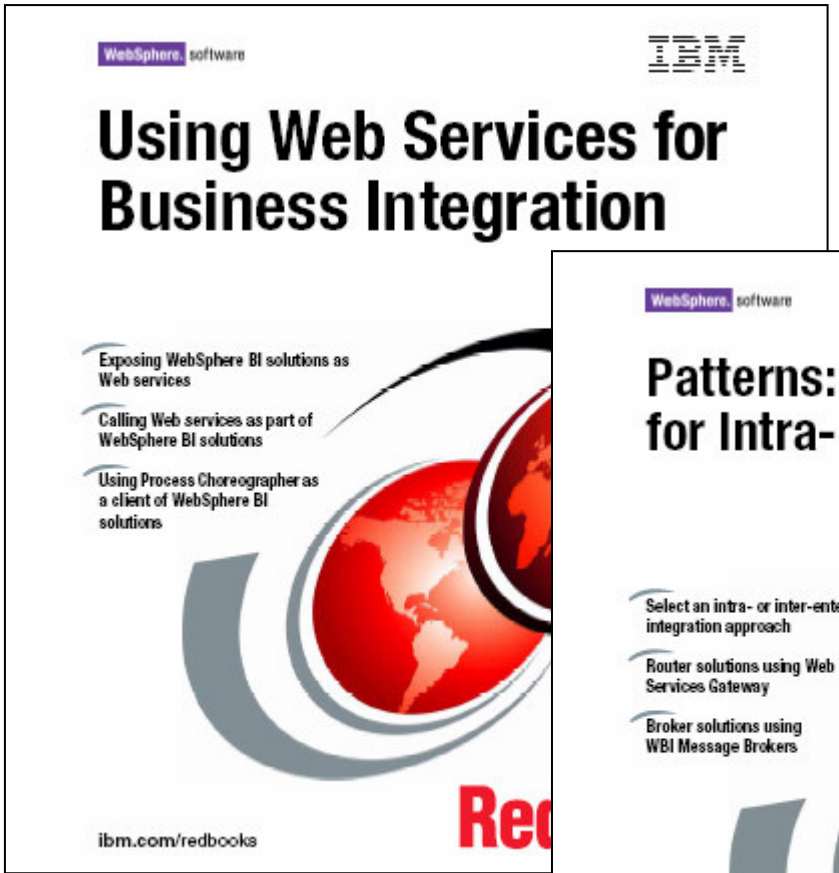
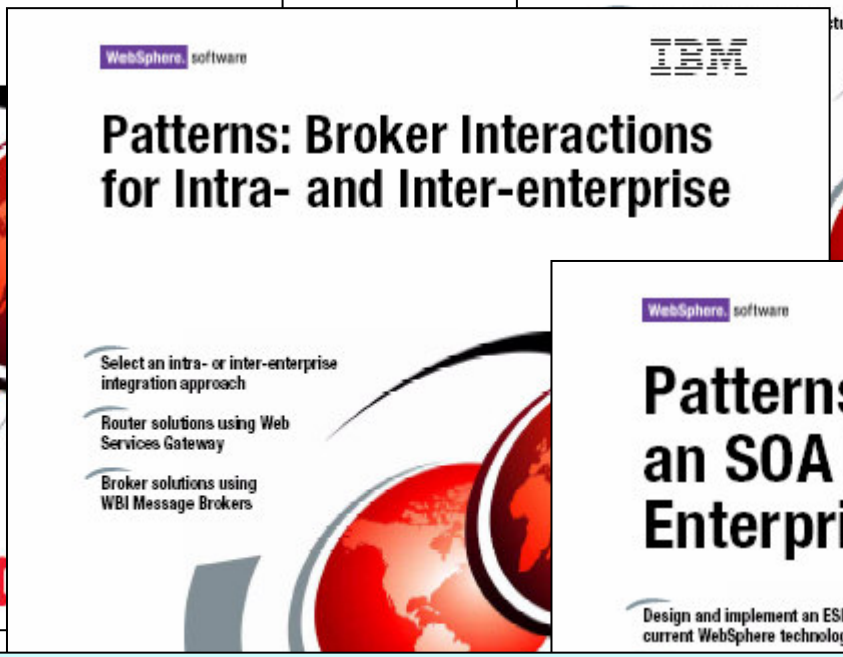
Education, Resources, Certification

- **developerWorks (vast library of technical information, forums, etc)**
  http://www-130.ibm.com/developerworks/websphere/
- **TechWorks PoT's (Proof of Technology)**
  http://pie.dfw.ibm.com/pie/event
- **IBM Learning Services (on-site, classroom, e-Learning)**
  http://www-128.ibm.com/developerworks/websphere/education/enablement/
- **IBM Redbooks (experiential resources)**
  www.redbooks.ibm.com
- **Software (links to documentation for any software product)**
  http://www-306.ibm.com/software/
- **Training and certification (roadmaps, programs, courses)**
  http://www-306.ibm.com/software/sw-training/
- **Events such as webcasts, seminars, conferences**
  http://www-306.ibm.com/software/sw-events/
- **Education Assistant (education on-demand)**
  http://www-306.ibm.com/software/info/education/assistant/

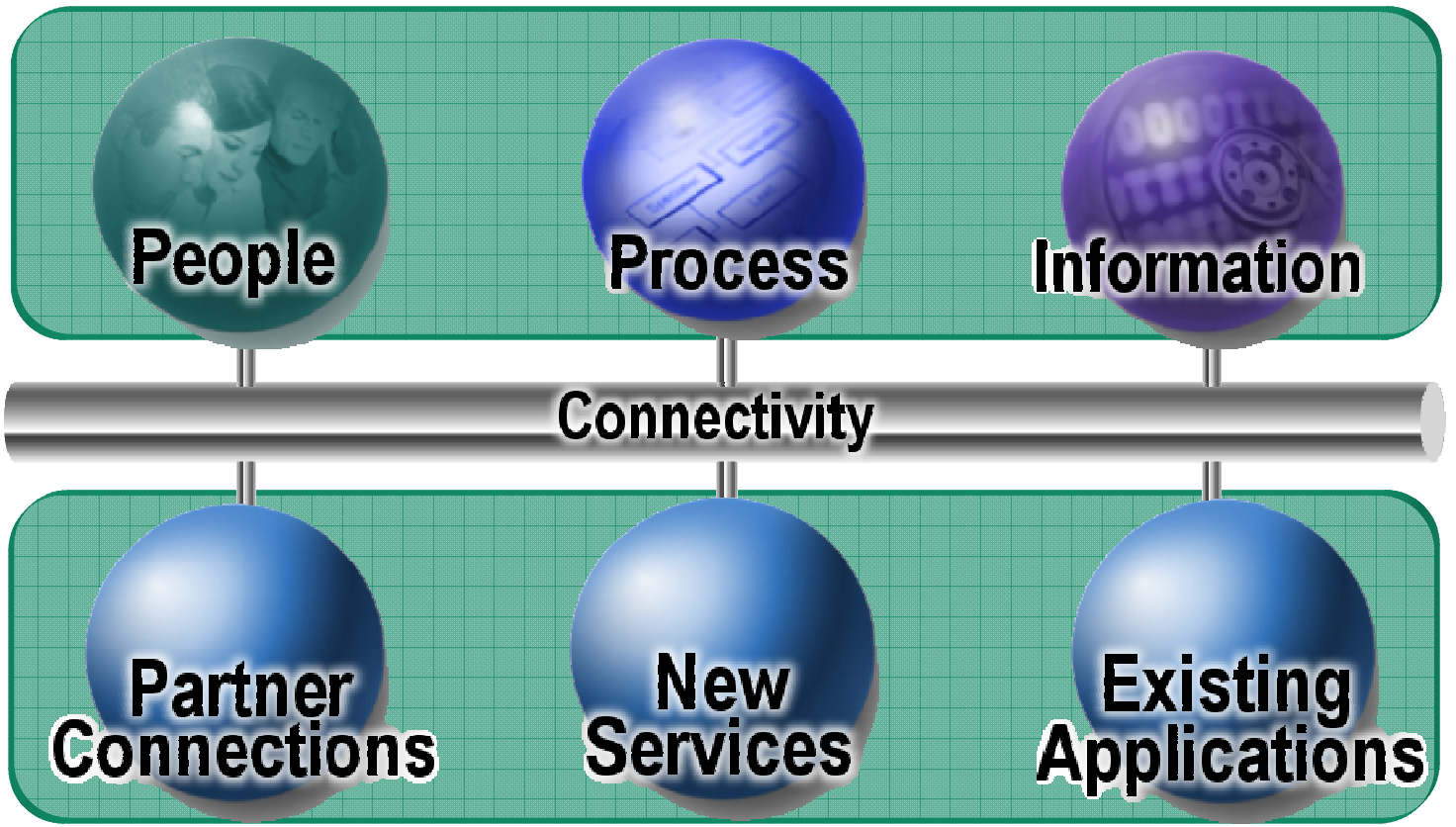
Redbooks





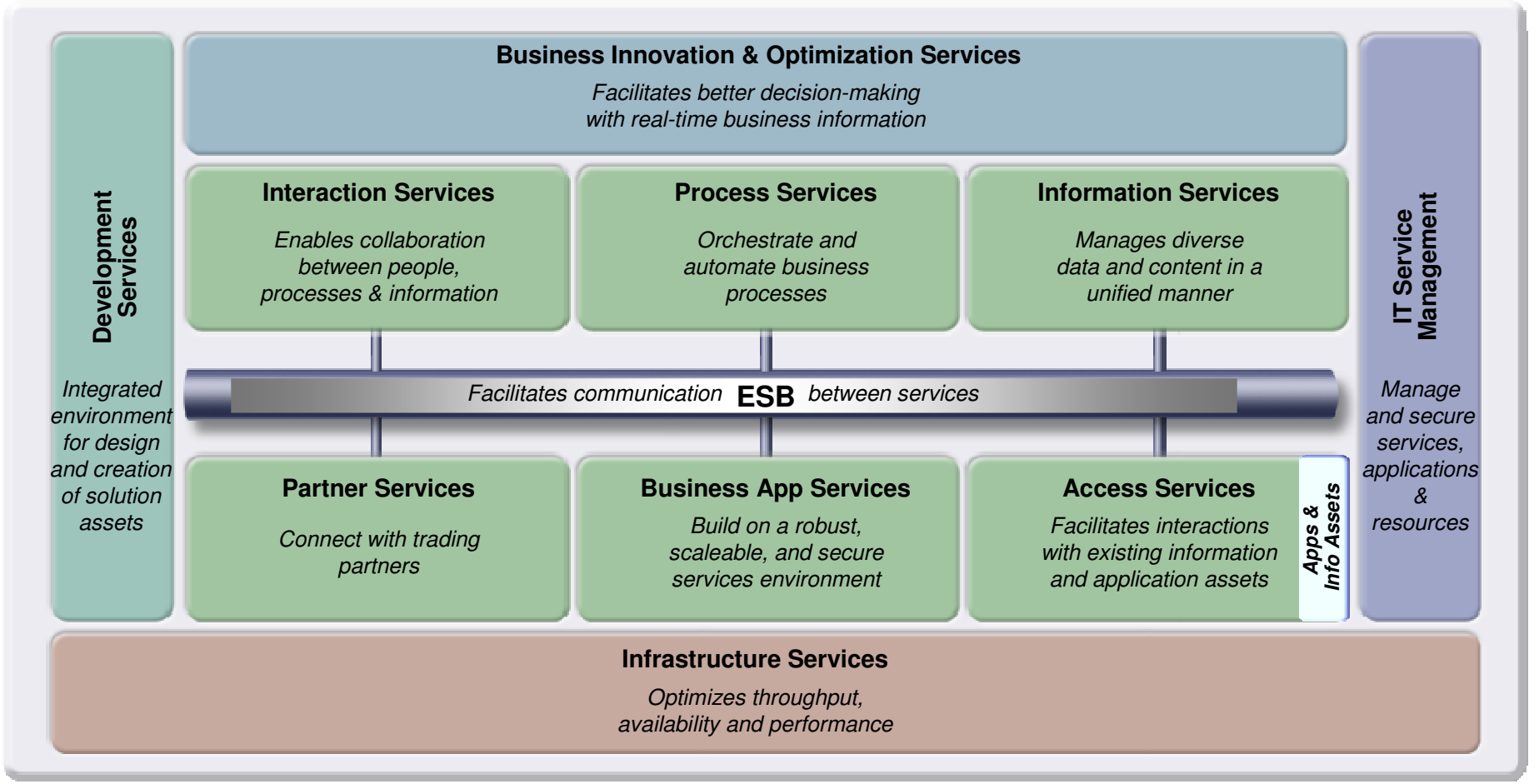
- **SOA and Web Services website**
  - http://www-306.ibm.com/software/solutions/webservices/
- **SOA and Web Services Application Briefs**
  - http://www-306.ibm.com/software/solutions/webservices/applicationbriefs.html

IBM's SOA Integration Reference Model

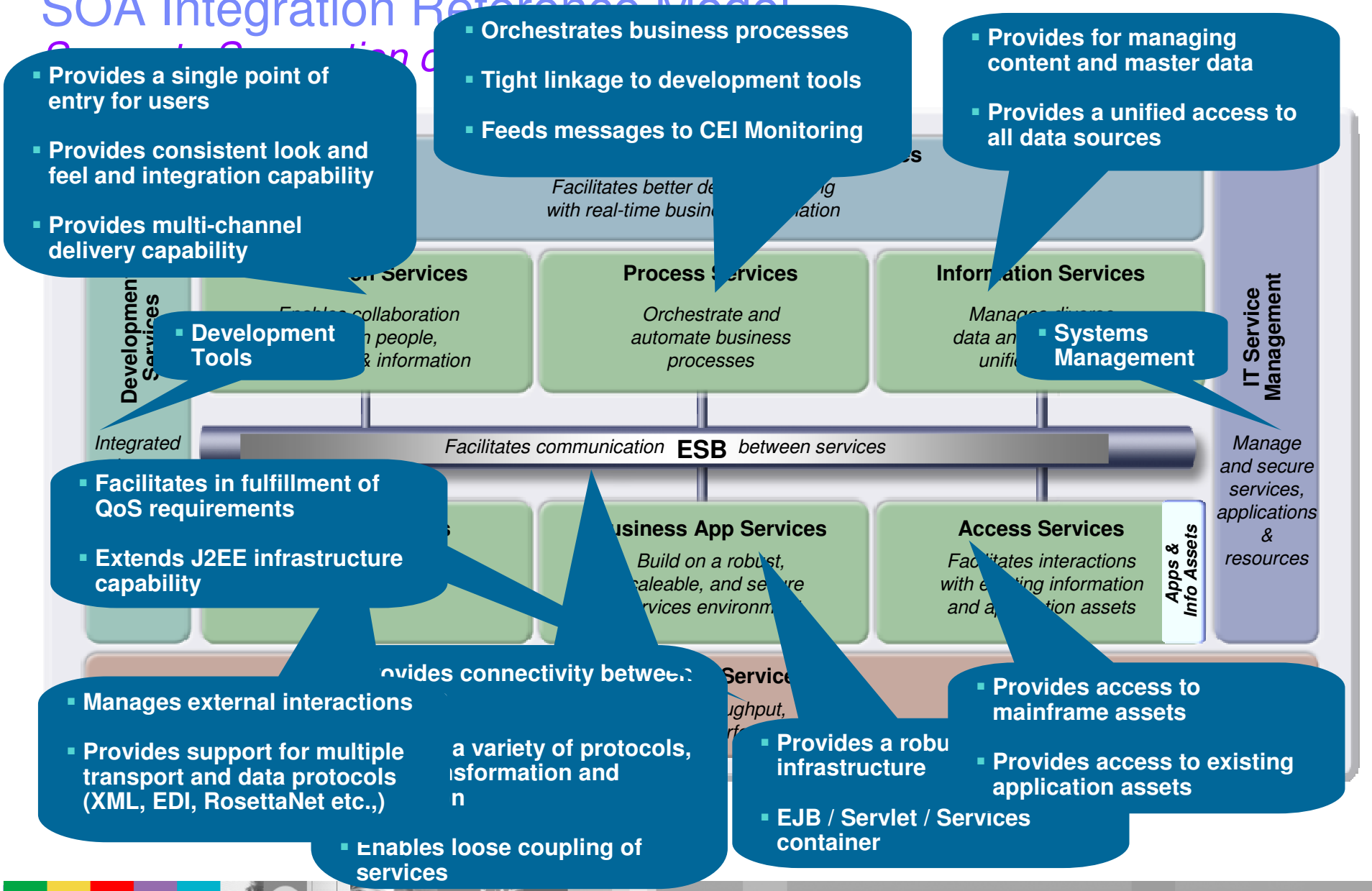


The SOA Integration Reference Model

Supports both "Separation of Concerns" & the "SOA Lifecycle"



SOA Integration Reference Model



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