Hybrid Cloud Integration: IBM Integration Bus

Peter Whitehead, Director, Hybrid Integration
IBM Integration Bus

Provides heterogeneous connectivity across enterprise systems, applications and data
What makes IBM Integration Bus the Marker Leader?

Scalability and Performance
High message volumes in complex IT environments

Ease of Use
Client choice of developer tools
Extensive open standards support

Connector Range
Large breadth of adapters, platforms and protocols

Multiple Editions
Different editions to suit different requirements and budgets

IBM Support
Over 4,000 certified specialists, extensive network of Business Partners and ISVs

Extended Value
Built in features that simplify and extend value
Hybrid Integration Personas

Automator
- LoB Professional
- Data Scientist
- SaaS Power User
- Biz/System Analyst

Integrator
- Shadow Integrator
- Integration Specialist

Developer
- API Developer
- Full Stack Developer
- Front End Developer

IBM Hybrid Integration Suite
- AppConnect
- Cast Iron
- Integration Bus
- API Connect
Andre
App Developer

Shavon
API Administrator

Isaac
Integration Developer

Cassie
Marketing

IBM Integration Bus

API Connect

App Connect
IBM's plans, directions, and intent are subject to change or withdrawal.
IBM Integration Bus

Cloud
- IIB on Cloud Offering
- Production support on Docker
- Deploy on AWS, Azure, SoftLayer
- Salesforce and LoopBack Request
- CHEF scripts

Digital Transformation
- REST APIs and REST Request
- Push to API Connect
- Web Hooks to App Connect
- MQTT Connector including SSL for IoT

Analytics
- Analyse data in real-time
- Embedded ODM
- Analytics engine integration (incl. Github R node)

Open and Available
- Free Developer Edition
- Integration Community
- Connector Framework
- GitHub Repository

Productive & Intuitive
- Web administration
- Built-in unit testing
- Patterns and tutorials
- Business Transaction Monitoring

Enterprise Grade and Lean
- Zero pre-reqs
- Radically simplified, install < 10 mins
- Market leading performance
- MQ Flexibility
- Global Cache enhancements
Global Cache upgrade to WX Sv8.6 (currency + XIO)
Access the global cache from a graphical map
Global Cache Performance and tuning enhancements
1-click Push REST APIs to API Connect from the IIB Toolkit
CICS Request node support for 2 Phase Commit
TCPIP Report properties enhancements
WESB Conversion tool enhancements
Business Transaction Monitoring
Oracle stored procedure support in a graphical map
Callable Flows for Hybrid Cloud scenarios
Salesforce Request node
JSON Schema support for graphical maps
Create a REST API without needing a Swagger document
LDAP Authentication for administration changes
Web UI Activity Log view for message flows
MQTT SSL and dynamic configuration
Bulk push REST APIs to API Connect from IIB Web UI
REST Request, REST Async Request and LoopBack Request nodes
HTTP and REST enhancements – Logging, YAML support, REST APIs with node-wide listener

Since IIBv10 … We’ve been busy!

- Increased platform and OS support:
  - Docker v1.7.1 and above
  - RHELv7 (x86 and Power Big Endian)
  - Linux Power Little Endian
    - (RHELv7.1, SLESv12, Ubuntu 14.0.4)
  - SLESv12 (x86 and Z Systems)
  - OS/X Open Beta
IIBv10 – Install Simply, Quickly & Get Productive!

- Radically Simplified Packaging and Installation
  - Full function, simple, single package install
  - Developer Operating Systems contain Toolkit and Server
    - Total size approx. 1.3 GB
  - Server Operating Systems contain only server
- Other changes
  - Full entitlement to MQ remains
  - MQ no longer packaged
    - Default queue manager for IB node for backwards compatibility
- Built-in Unit Test Environment
  - Developer tools have built-in unit test server
    - Fixed name of TESTNODE_<userid>
  - Started and stopped with tools
  - Can still test / deploy to manually created local and remote servers
Flexible MQ Topologies

- Provide more flexible topology options for MQ access
  - Many benefits include simplicity, scalability, availability & migration
  - Relationship evolves to the same as other resource managers – i.e. optional
  - Multiple Buses connected to a single Queue Manager
  - Corresponding updates for commands, CMP & Admin tools

- Automated installation simplified
  - MQ resources will not be installed at the same time
  - Reduces dependency management
  - Simplifies cloud-based installs
  - If MQ is installed, then IIB will detect this and configure appropriately

- IB now supports Local and Remote queue managers
  - Allows IB to be remote from its queue manager
  - Works with single MQ IB support to further simplify MQ topology
  - Many other internal features within IB can exploit this flexibility

- Many MQ Node related Enhancements
  - Input node to support both local & remote queue managers
    - Includes easy-change policy based control of sources
    - Also applies to MQGet and MQOutput/MQReply nodes

- When a queue manager is not available...
  - Connection management and retry

- Support for MQv9 added in IIBv10.0.0.6
MQ – Other important considerations

- **Administration and Security**
  - IIBv9 relies on access Control Lists held as permissions on MQ queue objects
  - IIBv10 will offer a file-based equivalent out of the box
  - mqsichangeauthmode command to select queue or file based

- **Publish Subscribe**
  - Alternative embedded MQTT based capability
  - Still publish to a default queue manager via MQ if provided
  - No extra install or moving parts required
  - Resource Statistics continue to work without MQ

- **IIB Integration API**
  - Admin interface changed to use Web Sockets, not MQ
  - New Java class for describing the connection
  - Web admin port provides single entry point, consolidated security model

- **High Availability**
  - An Integration Node can be controlled as an MQ Service
  - More Active/Active architectures now Node and Queue Manager link no longer required

- **Transactionality**
  - IIB can manage transactions, or use MQ to provide two-phase (XA) coordination
  - IIB managed transactions will continue to support all resource managers
  - Global 2PC provided by MQ (distributed) will continue to be supported.
  - Coordinating Queue Manager must be local, and designated as the only MQ resource

- **Some WebSphere MQ uses still remain**
  - Record & Replay
  - EDA nodes
  - Script provided to optionally create required MQ objects
IIB and Cloudiness

**On-Premises (BYO H/W)**
- Code
- Data
- Runtime
- Middleware
- OS
- Virtualization
- Servers
- Storage
- Networking

**Platform Managed**

**Pattern Managed via Console**

**Speed of Operation**
Manage & maintain stable, mission critical apps
Systems of Record

- IIB on IaaS
- IIB on PureApplication Service

**Speed of Innovation**
Explore, develop and deploy for growth opportunities
Systems of Engagement, Microservices

- IBM Bluemix
- IIB in Docker
- IIB on Cloud
IBM Integration Bus and Docker!

- **Creating IIB Docker images**
  - Developer edition binaries are automatically linked from Github dockerfile)
  - Docker containers securely isolate applications on a single host
  - No need for an entire Hypervisor / Virtual Machine for each container
  - Run many containers simultaneously and quickly scale
  - Launch when needed and then shut down when not!
  - Docker containers spawned from one image offer great consistency for solving problems at scale

- **Running IIB in a Docker container**
  - Run iib commands against the running broker, eg use "docker exec bash -c mqsilist" with mqsiprofile set on login (or via ssh)
  - Retain a means of syslog message capture
  - Retain access to workpath directories for diagnostic purposes.
  - Use docker volumes for persistent data independent of container lifecycle
CustomerDatabaseV1

Stopped

My first integration

Contents
CustomerDatabaseV1.bar

Public Endpoints
View how to invoke this integration

Host: https://ibm-integrationbus.gambloncloud.com/
/customerdb/v1/customers/{customerid}
/customerdb/v1/customers

https://ibm-integrationbus.gambloncloud.com/customerdb/v1/customers
IIB on Cloud Available Nodes

- CallableFlowInvoke
- CallableInput
- CallableReply
- Compute
- Database
- DatabaseInput
- EmailInput
- EmailOutput
- Extract
- Filter
- FlowOrder
- HTTPAsyncRequest
- HTTPAsyncResponse
- HTTPHeader
- HTTPInput
- HTTPReply
- HTTPRequest
- Input
- JavaCompute
- Mapping
- MQGet
- MQInput
- MQOutput
- MQReply
- Mapping
- Output
- Passthrough
- RESTAsyncRequest
- RESTAsyncResponse
- SOAPAsyncRequest
- SOAPAsyncResponse
- SOAPInput
- SOAPReply
- SOAPRequest
- Throw
- Trace
- TryCatch
- Validate
- XSLTransform
Moving IIB to the Hybrid Cloud

- Cloud
  - IIB only
  - IIB on Cloud
    - Callable Flow
  - IIB Flow Invoke

- Ground
  - IIB on Cloud
    - Flow Invoke
  - Callable Flow
  - IIB Agent only

- "Cloud Bursting"
- "Callable Flows"
- "Port Forwarding"
Securely connecting IIBoC back to on-premise

- Uses mutual authentication using IIB provided certificates
- Only explicitly configured on-premise endpoints are accessible
Callable Flows

CallableFlowInvoke Node Properties - CallableFlowInvoke

<table>
<thead>
<tr>
<th>Description</th>
<th>App2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target Application*</td>
<td>UniqueEndpoint</td>
</tr>
<tr>
<td>Target Endpoint Name*</td>
<td>UniqueEndpoint</td>
</tr>
<tr>
<td>Request timeout (sec)</td>
<td>120</td>
</tr>
</tbody>
</table>

CallableInput Node Properties - CallableInput

<table>
<thead>
<tr>
<th>Description</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Endpoint Name*</td>
<td>UniqueEndpoint</td>
</tr>
</tbody>
</table>

CallableReply
“I need to access stock levels via an API”

André
App Developer

Shavon
API Administrator

Provide controlled access to API

Isaac
Integration Developer

IBM Integration Bus

Request API

Provide API implementation

API Connect
Creating an IIB REST API

- Header

REST API base URL: /CustomerTransformV1

You can access the operations in the REST API by pasting your web browser to the following URL, where <hostname> is the host name and <port_number> is the port number:

http://<hostname>:<port_number>/CustomerTransformV1

- Resources

```
GET /get1
Name Parameter type: Data type: Format: Required: Description:
Response status: Response message: Array: Type:
200 The operation was successful.
```

```
POST /post1
Name Parameter type: Data type: Format: Required: Description:
```

```
PUT /put1
Name Parameter type: Data type: Format: Required: Description:
```

```
DELETE /delete1
Name Parameter type: Data type: Format: Required: Description:
```

- Model Definitions

<table>
<thead>
<tr>
<th>Name</th>
<th>Array</th>
<th>Type</th>
<th>Format</th>
<th>Required</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>{}</code> customer</td>
<td></td>
<td></td>
<td></td>
<td>object</td>
</tr>
</tbody>
</table>
Andre
App Developer

Shavon
API Administrator

“I need to access stock levels via an API”

Isaac
Integration Developer

IBM Integration Bus

- As and expert in IBM Integration Bus Isaac can easily create develop RESTful API’s and publish them to IBM API Connect from the tool kit or the Web UI
- Isaac can create API’s for flows and export them as a swagger definitions for consumption in other API management tooling
JSON Schema in the Graphical Mapper

- Easy graphical map creation from JSON Schema
  - Select JSON types from Swagger for source or target
  - When creating maps in a REST API Operation subflow, offer to populate the source and target from JSON types
  - Automatic update and validate the Query Path parameters edited within a REST API and used in a map
  - Add new Path Parameters section to LocalEnvironment

[Image of graphical mapper with JSON schema examples]
LoopBack Request Node

- JavaScript growing as a language server-side, especially popular in the mobile dev community
- Event-driven, non-blocking I/O model that makes node.js perfect for data-intensive, real-time applications
- IIB embeds node.js within the Integration Server process on Windows and Linux
- Create, Retrieve, Update, Delete data records in external systems
- Interact with NoDQL databases such as MongoDB, Cloudant and PostgreSQL
- LoopBack is an Open Source node.js framework for authoring connectors – large open source catalog available on line
- npm tool helps you download and install LoopBack connectors which others have already written
- Request and Response body data sourced from input message by default, but can be from elsewhere e.g. Environment tree
- Chain multiple REST Requests together without intervening transformations
- Accept header and Content-Type rules interact with standard IIB message parsers as you would expect
- Split request / response processing into separate threads of execution using REST Async Request and Response nodes
- Activity log for the message flow provides HTTP status code, response size, and total request time.
Other new REST and HTTP Enhancements

- Swagger can now be stored in Application and Library projects in addition to REST API projects
- YAML format Swagger is also supported
- Casts for JSON types in the Graphical Mapping node
- HTTP Input Query Parameter splitting into Local Env
- REST APIs can now be deployed to the IIB runtime to use the node-wide HTTP listener
- CORS support is added to the node-wide listener too

When IIB responds to an inbound HTTP request, you can add a new **X-IIB-Timing** property to the HTTP Header to describe elapsed timings for the IIB processing of the request [accessLog = true]

```bash
mqsichangeproperties TESTNODE_10006 -b httplistener -n accessLog -v true
```

**Tomcat Access Log Valve feature is provided to add a new access log file to the IIB workpath [accessLogPattern]**

```bash
mqsichangeproperties TESTNODE_10006 -b httplistener -o HTTPConnector -n accessLogPattern -v "%h %l %u %t '%r' %s %b '%{Referer}i' '%{User-Agent}i' IIB:'%{X-IIB-Timing}o'"
```
- Use IIB or IIB on Cloud to interact with a Kafka Broker providing distributed commit log based messaging service
- KafkaProducer and KafkaConsumer nodes for connecting IIB message flows with Kafka
- Connect to either a private Kafka Server implementation or the IBM Bluemix MessageHub implementation
New and Improved Nodes and Connectors

- (S)FTP support has been added to the FileRead node
  - FileRead extended to match FileInput and FileOutput and provide remote transfer of files into IIB via FTP and SFTP
- MQTT Connectors
  - Delivered and supported by IIB in v10
  - Easy to use input and output connectors to MQTT servers
  - Uses open framework for platform independent connectors
  - V9 Source freely available on Github website under flexible EPL
- Design, Deploy and Operational Policy
  - Node properties form policy e.g. connection details, host, topic etc.
  - Generate Policy from node properties
    - Operationalized via Web UI and Commands
    - Store as document with URL
    - Save to IIB runtime from IIB Toolkit
Integration with IBM Watson IoT using MQTT

- Static node property, and dynamic overrides via either LocalEnvironment or BAR file
- Utilises Integration Server trust store for storage of certificate chains (IoT messaging.pem)

```bash
mqsichangeproperties TESTNODE -e default
   -o ComIbmJVMManager -n truststoreType -v JKS
mqsichangeproperties TESTNODE -e default
   -o ComIbmJVMManager -n truststoreFile -v "C:\Program Files\IBM\IIB\10.0.1267.5\key.jks"
mqsichangeproperties TESTNODE -e default
   -o ComIbmJVMManager -n truststorePass -v default::truststorePass
mqsichangeproperties TESTNODE -e default ::truststorePass
   -u na -p changeit
```

- Security identity relates to mqsisetdbparms
- For IBM Watson IoT, Username is the IoT API Key and Password is the IoT Authentication token:

```bash
mqsisetdbparms TESTNODE -n mqtt::IOTFIdentity
   -u "a-fted2k-ha10xx3uam" -p ?P@RwOvS(hO(4wu3Bb
Isaac
Integration Developer

Cassie
Marketing

“I need to send marketing emails when stock levels change”

Request ability to trigger actions based on stock level changes

IBM Integration Bus

App Connect
The App Connect 1 slide summary!

- A simple, cloud-based integration platform, running in a Bluemix environment, built on SDK for Node.js
- Utilises common architectural building blocks: Connector service, Message Hub, Bluemix Secure Gateway
- A “flow” listens to a single application and does something to another single application
- App Connect can also connect apps if they are on a private network using the Bluemix Secure Gateway component (35MB client component runs on-premise – OS X, Windows or Linux)
Webhooks is a simple HTTP notification pattern, allowing a user to define an HTTP callback (~"subscribe") for a given hook
- E.g. /crm/cust/hook or /warehouse/stock/hook

To create a webbook, POST to the URL {IIB root}/hookpath

An id is returned to the post which uniquely identifies the subscription for further calls

A callback object structure is used to provide a URL to callback on when events are published

<table>
<thead>
<tr>
<th>REST operation</th>
<th>Webhook path</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>POST</td>
<td>{IIB root}/hookpath/</td>
<td>Create a subscription</td>
</tr>
<tr>
<td>GET</td>
<td>{IIB root}/hookpath/</td>
<td>List subscriptions</td>
</tr>
<tr>
<td>GET</td>
<td>{IIB root}/hookpath/{id}/</td>
<td>Get a subscription</td>
</tr>
<tr>
<td>PUT</td>
<td>{IIB root}/hookpath/{id}/</td>
<td>Update a subscription</td>
</tr>
<tr>
<td>DELETE</td>
<td>{IIB root}/hookpath/{id}/</td>
<td>Delete a subscription</td>
</tr>
</tbody>
</table>
Note the complete tree is passed to the callable flow and updated there.

Override Target Application if the input message contains JSON.Data.overrideApplicationName
Search application library

Salesforce  Gmail  SAP  Google Sheets

Do you have an application definition file?  Add your application now
Is there an application you use that you don’t see in our library? Let us know.  Contact us
Add Application

Add a new application to the App Connect library by importing an IBM Integration Bus application definition file, and give it a name and description. Learn more

Application name
OurWarehouse01

Description
Get told when there are new shirts

Select a network (optional)

Connect a new Network

warehousedefinition.yaml

Is there an application you use that you don’t see in our library? Let us know. Contact us
IBM App Connect provides Cassie with a simple way to automate tasks required by the line of business without requesting new development activities from central IT.

IBM App Connect provides a Isaac an easy way to provide access to core systems of record for teams in his Enterprises lines of business.
Shared Libraries

- Apps / Libs were major features introduced in V8 and V9
  - Enhanced to fulfil most popular user requests
  - Libraries can now be shared across multiple applications for a broad range of assets
  - Sub-flows are now independent artefacts, significant storage reduction, consistency

Shared Libraries
- Libraries can now be referenced by one or more applications
  - Libraries deployed independently of applications – “shared”!
  - Applications will not get “own copy”
  - Libraries can still reference other libraries
- Shared Library is the default library type
- Assets in multiple libraries within application are shared
  - Notably schemas, also Maps, ESQL, Java etc.

Shared Library Restrictions
- Subflows but not message flows are allowed in shared libraries, other minor subflow restrictions
- Minor restrictions for ESQL (e.g. empty schema)
- Application hosted schemas can’t import include schemas from shared libs
- Java classes in shared libraries are in separate classloaders (unless one shared library references another shared library)
LDAP Authentication for IIB System Administration

- All remote access to IIBv10 through the web port (REST, Toolkit, Web UI)
  - Use the mqsichangeauthmode command to enable / disable administration security
  - Choose queue or file based authorization

- Authenticate users against LDAP
  - LDAP can help centralise user accounts for multiple applications, can control password complexity, timeout, invalidity etc.
  - Password parameter on the mqsiwebuseradmin command becomes optional
  - Location of LDAP endpoint is supplied via mqsichangeproperties command

IBM Integration Bus Node

Web User + Web Password

Remote CMP Application

Local CMP Application

Runs as System User

Authorization (all requests)

Web User + Web Password

Mapped to System User

LDAP Server

Integration Server
Business Transaction Monitoring Conceptual Model

Business Transaction Instance (Conceptual diagram)

Business Transaction X (BTX) definition:
- **Name:** Purchase Order
- **Description:** Online purchase order submitted by retail channel
- **Identifier:** Customer order number

Business Events:
- Order placed
- Dispatched
- Confirmed
- Delivery attempted
- Delivery successful
- Shipment missing

BTX instances:
- **PO#: 420000**
  - Status: Success
  - Order placed
  - Confirmed
  - Dispatched
  - Delivery attempted
  - Delivery successful

- **PO#: 421111**
  - Status: Error
  - Order placed
  - Confirmed
  - Dispatched
  - Delivery attempted
  - Shipment missing

- **PO#: 422222**
  - Status: Started
  - Order placed
  - Confirmed
  - Dispatched
  - Delivery attempted

- **PO#: 423333**
  - Status: Unknown
  - Order placed
  - Dispatched
  - Delivery attempted

Event timeline:
- **Wednesday 8th Jan 2014**
  - Order placed 09:00:41
- **Friday 10th Jan 2014**
  - Delivery attempted 10:54:22
Business Transaction Monitoring

- Business Transaction Monitoring tracks a message across multiple message flows
  - Report on the lifecycle of a message payload through an end-to-end enterprise transaction
  - Defines flows contributing to the transaction, and monitoring events for start, end or failure.
- Aggregated view of business information on bus
- Link flows and events to owning business transactions
- Easily configured by developers or operators
- Significant evolution of Record and Replay & WESB FEM

- Tracking Business Transactions
  - Web UI views to define contributing flows and event chronology
  - Runtime Data Recorder component
  - Visualisation of status
IIB Embedded Global Cache

- **IIB’s embedded Global Cache provides an elastic, scalable, in-memory data grid for storing reusable data**
- Share data across separate integration servers and integration nodes
- Frequently used for storing correlation information and for caching semi-static data
- The embedded cache is easier to administer than a full external WebSphere eXtreme Scale grid
The Mapping node now provides interactions with the global cache
- Use a Cache Put transform to store data in the cache
- Use a Cache Get transform to retrieve data from the cache (e.g., for processing or routing)
- Use a Cache Remove transform to remove a key-value pair from the cache
- You can add a Cache Failure transform to handle any exceptions returned by the cache transforms

Input elements are dragged into the Cache transform
- Edit the nested map
- Output elements in Cache transform are prepopulated:
  - Key, MapName, CacheName and TimeToLive

Field1 string
Field2 string

Assign
Assign
Assign

ExampleMessageFlow_Mapping

Cache Put
Cache Get
Cache Remove
Summary

• IIB is a core part of the IBM Hybrid Integration strategy

• IBM Continue to invest to provide capabilities to enable Hybrid Integration

• IIB integrates with App Connect and API Connect to enable integration for a wide set of personas.

• More information at https://developer.ibm.com/integration/
Thank you and Questions?
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Further Global Cache Enhancements

- Embedded global cache capability (client and embedded grid) is upgraded to use WX Sv 8.6.0.8
  - eXtreme IO transport (XIO). XIO replaces the Object Request Broker (ORB) protocol which was bound to native Java client apps. XIO offers better performance and throughput.
  - eXtreme Data Format (XDF). When using the XIO transport, XDF becomes the default serialization technology when storing keys and values in the data grid: Map copy mode is set to COPY_TO_BYTES in object_grid_xio.xml

- From IIBv10.0.0.2, the embedded global cache can use an “Enterprise Data Grid” (XIO+XDF).
  - Integration node must be at function level 10.0.0.2 or later.
  - If you have a multi-node cache topology – it is all or nothing; all nodes must be set to use an enterprise data grid, or all nodes must be set not to use the enterprise data grid.
  - Backwards compatibility to use ORB stil available for existing IIB grids defined pre-10.0.0.2

- From IIBv10.0.0.4:
  - Change the lockStrategy property for a backingMap – PESSIMISTIC / OPTIMISTIC / NONE
  - Change the replicaReadEnabled property for a set of Maps
  - Compelling performance improvements possible with these new configuration options

```bash
mqschangelogbroker TESTNODE_v10 -b C:\policy_two_brokers.xml

mqschangelogbroker TESTNODE_v10 -f 10.0.0.2
```