Advanced Monitoring Asset for IBM Integration Bus

Monitoring the business flows of IBM Integration Bus v10

Patrick MARIE
IBM Cloud Services consultant
pmarie@fr.ibm.com
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Introduction

- Monitoring message flows has been a concern for many customers since the origin of IBM Integration Bus (then named MQ Integrator):
  - Typical questions are:
    - What are my IIB servers and nodes doing?
    - How many message flows have been processed today?
    - Has the flow with reference “xxx” been processed? When and with which result?

- IBM Integration Bus v10 provides an infrastructure for monitoring:
  - Events can be generated by the message flows and routed to MQ topics.

- Several options based on this infrastructure exist for monitoring the flows:
  - IBM Business Monitor.
  - Custom applications can be implemented by customers or integrators:
    - The “Advanced Monitoring Asset for IBM Integration Bus” is such an application and an advanced monitoring solution which extends the capabilities of the “Business Transaction Monitoring” functionality of IIB.
Infrastructure provided by IBM Integration Bus for monitoring

- The message flows can be set to emit monitoring events as MQ messages while being executed.
- These messages are routed to MQ topics.
- The monitoring applications must subscribe to these topics in order to receive the monitoring events and then use them as needed to enable administrators to monitor the message flows.
Native “Business Transaction Monitoring” of IIB v10

- A function included in IIB v10
- Provides basic monitoring functionalities for the business transactions
Advantages and limitations of the “Business Transaction Monitoring” functionality of IIB v10

- **Advantages:**
  - Provides basic monitoring functionalities for the business transactions.
  - Included in IIB and supported by the lab.

- **Limitations:**
  - Limited to monitoring one single integration node at a time.
  - Limited information about the flows.
  - Limited filtering:
    - Limited set of filtering criteria: not possible by dates/times, by application data…
    - No hierarchical filtering (for example: by node > by server > by message flow).
  - No statistics.
Monitoring message flows with IBM Business Monitor

- An independent product to be added to the configuration
- Provides generic monitoring functionalities for the business transactions
Advantages and limitations of using IBM Business Monitor with IIB v10

- **Advantages:**
  - Provides full monitoring and statistics functionalities for the business transactions.

- **Limitations:**
  - An independent product which needs to be purchased in addition to IIB.
  - A monitoring model needs to be created for every message flow to be monitored.
Monitoring message flows with implementing a custom application

- Custom solutions can be implemented on top of the infrastructure provided by IIB for monitoring.
Monitoring message flows with implementing a custom application

- It is possible to implement custom applications for monitoring the message flows or the business transactions.
- Such applications must subscribe to the MQ topics used by IBM Integration Bus in order to receive monitoring events.
- It is then up to the developers to implement the logic needed to process the events and the GUI needed for the administrators to access the monitoring information.
- The Advanced Monitoring Asset for IBM Integration Bus was implemented according to these principles.
Purposes of the Advanced Monitoring Asset for IBM Integration Bus

- The “Advanced Monitoring Asset for IBM Integration Bus” is a monitoring application implemented on top of the monitoring infrastructure provided by IBM Integration Bus.

- It extends the capabilities of the native “Business Transaction Monitoring” of IBM Integration Bus v10:
  - Displays detailed information about the business flows.
  - Provides enhanced sorting and filtering:
    - More criteria: dates/times, nodes, servers, business flows, application data…
    - Hierarchical filtering (example: by nodes > by servers > by business flow types).
  - Provides statistics about the throughputs, the processing times…
  - Enables to monitor several integration servers and integration nodes from a single GUI.
  - Removes the need for a “monitoring model” (uses an implicit one), so that new business flows can immediately be monitored as soon as they are deployed and ready to publish events.
Architecture of the Advanced Monitoring Asset for IIB

Integration node

Integration server

Integration node

Integration server

Requests, messages, files…

Publish monitoring events

Requests, messages, files…

MQ topics

MQ Queue

MQ Queue

MQ Queue

MQ Queue

MQ Queue

Business flow

Requests, messages, files…

Publish monitoring events

Requests, messages, files…

MQ subscription

Advanced monitoring database (DB2 or Oracle)

Application server (WS Liberty profile or WAS)

JavaScript framework (HighCharts)

Firefox or Internet Explorer

Web GUI
Main components of the Advanced Monitoring Asset for IIB

- **Message Driven Bean:**
  - Reads event messages from the input MQ queue.
  - Extracts the monitoring data from the event messages.
  - For each event:
    - Creates an entry in the table of events.
    - Creates or updates an entry in the table of business flows.

- **Database (DB2 or Oracle):**
  - Table of events:
  - Table of business flows:
Main components of the Advanced Monitoring Asset for IIB

- **GUI:**
  - Enables administrators to query the business flow and event data from the database and list them and to build statistics.
  - Business flow instances can be queried and listed with detailed information.
    - Filters can be used for the queries in order to limit the matches.
    - The events received for a business flow instance can also be queried and listed.

<table>
<thead>
<tr>
<th>Id</th>
<th>Status</th>
<th>Start time</th>
<th>End time</th>
<th>Business flow type</th>
<th>Node / Server</th>
<th>Business data</th>
</tr>
</thead>
</table>
| 41405112049423130514457245537479bfe6fa1582176511c | Completed   | 2017-02-20 09:34:44.776 | 2017-02-20 09:34:44.776 | Small Business App | IB10NODE_Stud / default2 | Id: 12345
Details/Geography/Item/City: Paris
Details/Geography/Item/City: London
Details/Geography/Item/City: Berlin
Details/Geography/Item/City: Madrid
Value: 1
Details/Geography/Item/Country: France
Details/Geography/Item/Country: UK
Details/Geography/Item/Country: Germany
Details/Geography/Item/Country: Spain |
| 41405112049423130514457245537479bfe6fa1582176511d | Failed      | 2017-02-20 09:34:44.809 | 2017-02-20 09:34:44.81 | Small Business App | IB10NODE_Stud / default2 | Id: 12345
Details/Geography/Item/City: Paris
Details/Geography/Item/City: London
Details/Geography/Item/City: Berlin
Details/Geography/Item/City: Madrid
Value: 1
Details/Geography/Item/Country: France
Details/Geography/Item/Country: UK
Details/Geography/Item/Country: Germany
Details/Geography/Item/Country: Spain |
| 41405112049423130514457245537479bfe6fa15821765120 | Completed   | 2017-02-20 09:34:44.844 | 2017-02-20 09:34:44.853 | Retail Order         | IB10NODE_Stud / default2 | OrderId: 2
customerNumber: 5555
itemNumber: 1234-6789-1212
requestType: orderItem
itemName: Chocolate Fan
itemName: Chocolate chip cookies |
| 41405112049423130514457245537479bfe6fa15821765122 | Completed   | 2017-02-20 09:34:44.863 | 2017-02-20 09:34:44.883 | Retail Order         | IB10NODE_Stud / default2 | OrderId: 2
customerNumber: 5670
itemNumber: 3529-9999-1937
requestType: orderItem
itemName: ColumbiaSupreme
itemName: ColumbianTea |
| 41405112049423130514457245537479bfe6fa15821765124 | Completed   | 2017-02-20 09:34:44.918 | 2017-02-20 09:34:44.921 | Retail Order         | IB10NODE_Stud / default2 | OrderId: 3
customerNumber: 4785
itemNumber: 8876-5342-3847
requestType: orderItem
itemName: TealFan
itemName: CeylonBlackTea |
| 41405112049423130514457245537479bfe6fa15821765126 | Completed   | 2017-02-20 09:34:44.95  | 2017-02-20 09:35:02.001 | Multi Broker Transaction | IB10NODE_Stud / default2 | OrderId: 2
customerNumber: 5555
itemNumber: 1234-6789-1212
requestType: orderItem
itemName: Chocolate Fan
itemName: Chocolate chip cookies |
Main components of the Advanced Monitoring Asset for IIB

- **GUI:**
  - Statistics can be built from the results of a query and displayed as a bar chart.
  - Various statistics about the business flow throughouts and the processing times are offered.
Main menu of the GUI

- The main menu offers different types of queries with various filters to query business flows from the database and display them as a table.

**Advanced monitoring of IBM Integration Bus business flows**

Welcome in the Advanced Monitoring application for IBM Integration Bus business flows!

Please select an action in the above menu.
Querying and listing business flow instances

- Business flow instances are retrieved from the database and displayed with a rich set of information:
  - Id, status, start/end dates & times, business flow type, node(s)/server(s), business data.

Advanced monitoring of IBM Integration Bus business flows

<table>
<thead>
<tr>
<th>Id</th>
<th>Status</th>
<th>Start Time</th>
<th>End Time</th>
<th>Business flow type</th>
<th>Node / Server</th>
<th>Business data</th>
</tr>
</thead>
<tbody>
<tr>
<td>41451204942310514d752b637475b6fa1582176511c</td>
<td>Completed</td>
<td>2017-02-20 09:34:44.776</td>
<td>2017-02-20 09:34:44.776</td>
<td>Small Business Appl</td>
<td>IB10NODE_Std / default2</td>
<td>Id: 12345, Details/Geography/Location/Id: Paris, Details/Geography/Location/Id: London, Details/Geography/Location/Id: Berlin, Details/Geography/Location/Id: Madrid</td>
</tr>
<tr>
<td>41451204942310514d752b637475b6fa1582176511e</td>
<td>Failed</td>
<td>2017-02-20 09:34:44.809</td>
<td>2017-02-20 09:34:44.81</td>
<td>Small Business Appl</td>
<td>IB10NODE_Std / default2</td>
<td>Id: 12345, Details/Geography/Location/Id: Paris, Details/Geography/Location/Id: London, Details/Geography/Location/Id: Berlin, Details/Geography/Location/Id: Madrid</td>
</tr>
<tr>
<td>41451204942310514d752b637475b6fa15821765120</td>
<td>Completed</td>
<td>2017-02-20 09:34:44.844</td>
<td>2017-02-20 09:34:44.853</td>
<td>Retail Order</td>
<td>IB10NODE_Std / default2</td>
<td>Id: 12345, Details/Geography/Location/Id: Paris, Details/Geography/Location/Id: London, Details/Geography/Location/Id: Berlin, Details/Geography/Location/Id: Madrid</td>
</tr>
<tr>
<td>41451204942310514d752b637475b6fa15821765122</td>
<td>Completed</td>
<td>2017-02-20 09:34:44.883</td>
<td>2017-02-20 09:34:44.888</td>
<td>Retail Order</td>
<td>IB10NODE_Std / default2</td>
<td>Id: 12345, Details/Geography/Location/Id: Paris, Details/Geography/Location/Id: London, Details/Geography/Location/Id: Berlin, Details/Geography/Location/Id: Madrid</td>
</tr>
<tr>
<td>41451204942310514d752b637475b6fa15821765124</td>
<td>Completed</td>
<td>2017-02-20 09:34:44.918</td>
<td>2017-02-20 09:34:44.921</td>
<td>Retail Order</td>
<td>IB10NODE_Std2 / default</td>
<td>Id: 12345, Details/Geography/Location/Id: Paris, Details/Geography/Location/Id: London, Details/Geography/Location/Id: Madrid</td>
</tr>
<tr>
<td>41451204942310514d752b637475b6fa15821765126</td>
<td>Completed</td>
<td>2017-02-20 09:34:44.949</td>
<td>2017-02-20 09:34:44.986</td>
<td>Retail Order</td>
<td>IB10NODE_Std / default</td>
<td>Id: 12345, Details/Geography/Location/Id: Paris, Details/Geography/Location/Id: London, Details/Geography/Location/Id: Madrid</td>
</tr>
</tbody>
</table>

All business flows for the period from January 19, 2017 12:00:00 AM CET to August 6, 2017 3:48:01 PM CEST (from 15 to 21 of 10010):
Filtering on dates/times and business data

- Business flow instances can be filtered by dates/times and, optionally, by business data:
  - Wildcard characters (_ and %) can be used in the business data values.
Displaying business flow instances from various nodes/servers

- Business flow instances having executed on various nodes/servers can be monitored together.
- Business flow instances may start on a node/server, continue on other node(s)/server(s) and complete on yet another node/server.

<table>
<thead>
<tr>
<th>Id</th>
<th>Status</th>
<th>Start time</th>
<th>End time</th>
<th>Business flow type</th>
<th>Node / Server</th>
</tr>
</thead>
<tbody>
<tr>
<td>414d512049423130514d47525f53747509fc9c5892ec3b21</td>
<td>Completed</td>
<td>2017-02-19 16:09:54.932</td>
<td>2017-02-19 16:09:55.277</td>
<td>Retail Order</td>
<td>Start: IB10NODE_Stud / default</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>End: IB10NODE_Stud / default</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Other: IB10NODE_Stud2 / default2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>End: IB10NODE_Stud2 / default2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>End: IB10NODE_Stud / default2</td>
</tr>
</tbody>
</table>
Filtering failed business flow instances

- The query can also be limited to failed flow instances:

```
Advanced monitoring of IBM Integration Bus business flows

<table>
<thead>
<tr>
<th>Id</th>
<th>Status</th>
<th>Start time</th>
<th>End time</th>
<th>Business flow type</th>
<th>Node / Server</th>
<th>Business data</th>
</tr>
</thead>
<tbody>
<tr>
<td>41d53209231305149255625492325821765168</td>
<td>Failed</td>
<td>2017-02-20 09:34:46.235</td>
<td>2017-02-20 09:34:46.257</td>
<td>Small Business App</td>
<td>Start: BIONODE_Studio / default2</td>
<td>Details/Geography/Item/City: Paris Details/Geography/Item/Country: France</td>
</tr>
<tr>
<td>41d53209231305149255625492325821765168</td>
<td>Failed</td>
<td>2017-02-20 09:34:46.613</td>
<td>2017-02-20 09:34:46.612</td>
<td>Small Business App</td>
<td>Start: BIONODE_Studio / default2</td>
<td>Details/Geography/Item/City: Paris Details/Geography/Item/Country: France</td>
</tr>
<tr>
<td>41d53209231305149255625492325821765168</td>
<td>Failed</td>
<td>2017-02-20 09:34:46.975</td>
<td>2017-02-20 09:34:46.976</td>
<td>Small Business App</td>
<td>Start: BIONODE_Studio / default2</td>
<td>Details/Geography/Item/City: Paris Details/Geography/Item/Country: France</td>
</tr>
<tr>
<td>41d53209231305149255625492325821765168</td>
<td>Failed</td>
<td>2017-02-20 09:34:47.333</td>
<td>2017-02-20 09:34:47.333</td>
<td>Small Business App</td>
<td>Start: BIONODE_Studio / default2</td>
<td>Details/Geography/Item/City: Paris Details/Geography/Item/Country: France</td>
</tr>
<tr>
<td>41d53209231305149255625492325821765168</td>
<td>Failed</td>
<td>2017-02-20 09:34:47.858</td>
<td>2017-02-20 09:34:47.859</td>
<td>Small Business App</td>
<td>Start: BIONODE_Studio / default2</td>
<td>Details/Geography/Item/City: Paris Details/Geography/Item/Country: France</td>
</tr>
</tbody>
</table>

All failed business flows for the period from February 10, 2017 12:00:00 AM CET to August 12, 2017 10:56:03 PM CEST (from 6 to 10 of 1001):

- See all business flows
- See all failed business flows
- Monitor by integration nodes/servers
- Monitor by business flow times

Go to preceding | Go to beginning | Go to end | Go to next | Go to line | Home

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Hierarchical filtering of the business flows: by nodes, then by servers, then by flow types
Hierarchical filtering of the business flows:
by flow types, then by nodes, then by servers
Navigating in the list of retrieved business flows and sorting it

- Generally, only part of the list of the retrieved business flows gets displayed. Buttons enable to move forward and backward.

- The list can be sorted in various ways.

<table>
<thead>
<tr>
<th>Status</th>
<th>Start time</th>
<th>End time</th>
<th>Business flow type</th>
<th>Node / Server</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completed</td>
<td>2017-02-20 09:34:45.620</td>
<td>2017-02-20 09:34:45.632</td>
<td>Retail Order</td>
<td>IBIONODE_Stud2 / default</td>
</tr>
<tr>
<td>Completed</td>
<td>2017-02-20 09:34:45.0063</td>
<td>2017-02-20 09:35:02.067</td>
<td>Multi Broker Transaction</td>
<td>IBIONODE_Stud2 / default2</td>
</tr>
<tr>
<td>Completed</td>
<td>2017-02-20 09:34:44.5362</td>
<td>2017-02-20 09:34:44.347</td>
<td>Retail Order</td>
<td>IBIONODE_Stud2 / default</td>
</tr>
<tr>
<td>Completed</td>
<td>2017-02-20 09:34:44.388</td>
<td>2017-02-20 09:35:01.035</td>
<td>Multi Broker Transaction</td>
<td>IBIONODE_Stud2 / default2</td>
</tr>
<tr>
<td>Completed</td>
<td>2017-02-20 09:34:44.423</td>
<td>2017-02-20 09:34:44.426</td>
<td>Small Business App</td>
<td>IBIONODE_Stud2 / default2</td>
</tr>
</tbody>
</table>
Listing the monitoring events received for a business flow instance

- The events received for a business flow instance can also be displayed below the list of business flow instances:
Statistics about the throughputs and processing times of the business flows

- Statistics are requested from the main panel and calculated from the results of a query (possibly filtered) executed in the main panel.
- Several types of statistics are offered about the throughputs and processing times of the business flows:

```
<table>
<thead>
<tr>
<th>Id</th>
<th>Statistics: select type and display...</th>
</tr>
</thead>
<tbody>
<tr>
<td>414d5120494231305144d47525537475bfebaf15821765102</td>
<td>Statistics on throughputs by periods of time</td>
</tr>
<tr>
<td>414d5120494231305144d47525537475bfebaf15821765104</td>
<td>Completed: 2017-02-20 09:34:44.306 2017-02-20 09:34:44.353 Retail Order</td>
</tr>
</tbody>
</table>
```
Statistics about throughputs by periods of time

- Global throughputs (number of instances per periods of time):

![Statistics about IBM Integration Bus business flows](image-url)
Statistics about throughputs by periods of time

- The periods of time can be chosen: seconds, minutes, hours, days, weeks, months or years.
Statistics about throughputs by periods of time

- The throughputs can be split by results (completed, failed, in process/in doubt):

![Statistics about IBM Integration Bus business flows](image-url)
Statistics about throughputs by periods of time

- The throughputs can be split by business flow types:
Statistics about throughputs by periods of time

- The throughputs can be split by nodes or by nodes / servers:
Statistics about throughputs by periods of time

- The throughputs can be split by business data values:
Statistics about throughputs by nodes/servers and by business flow types

Statistics about IBM Integration Bus business flows

Business flow throughputs by integration nodes and servers

All business flows for the period from February 19, 2017 4:09:00 PM CET to February 19, 2017 4:16:00 PM CET (10000 flows):

Statistics about IBM Integration Bus business flows

Business flow throughputs by flow types

All business flows for the period from February 19, 2017 4:09:00 PM CET to February 19, 2017 4:16:00 PM CET (10000 flows):
Statistics about processing times by periods of time

- The minimum, average and maximum processing times are displayed by periods of time.
- The periods of time can be chosen: seconds, minutes, hours, days, weeks, months or years.

Statistics about IBM Integration Bus business flows

Business flow processing times by periods of time

All business flows for the period from February 7, 2017 12:20:00 AM CET to February 7, 2017 12:30:00 AM CET (9000 completed flows) by minutes:

[Graph showing processing times by periods of time]
Additional information

- Supported environments and products:
  - Windows 64-bit or Linux 64-bit.
  - IBM Integration Bus v10.0.
  - IBM MQ v7.1 or higher.
  - DB2 v9.0 or higher or Oracle 12c or higher
  - WebSphere Liberty Profile v8.5 or higher or WebSphere Application Server v8.5 or higher (Java 1.7 or higher).
  - HighChart JS from Highsoft (included in the asset as OEM).

- Supported languages: English, French, German and Spanish for the GUI.

- Available as an IBM Cloud Services asset (an evaluation version is available for free).
Conclusion

- The “Advanced Monitoring Asset for IBM Integration Bus” provides first-class monitoring and statistics capabilities for the business flows executed by IBM Integration Bus.

- Based on:
  - The infrastructure provided by IIB for implementing custom monitoring solutions.
  - Reputable components:
    - IBM MQ,
    - IBM DB2 or Oracle Database,
    - IBM WebSphere Liberty profile or WebSphere Application Server,
    - HighCharts JavaScript framework.

- Intuitive and easy to use GUI (no training needed).

- Little to be done to enable monitoring for new flows:
  - Uses a generic implicit “monitoring model”.
  - A new flow can be monitored as soon as it is deployed and ready to publish monitoring events.
MQ architecture

IIB message flows

Source queue manager

Remote queue

Subscription

Topics

Sender channel

Target queue manager

Queue

Get

Advanced Monitoring Asset MDB

Advanced Monitoring Asset for IBM Integration Bus

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