Leveraging WBI (Broker) Monitoring

Introduction

WBI (Broker) provides the ability to get considerable data about its operation and the behavior of your message flows.

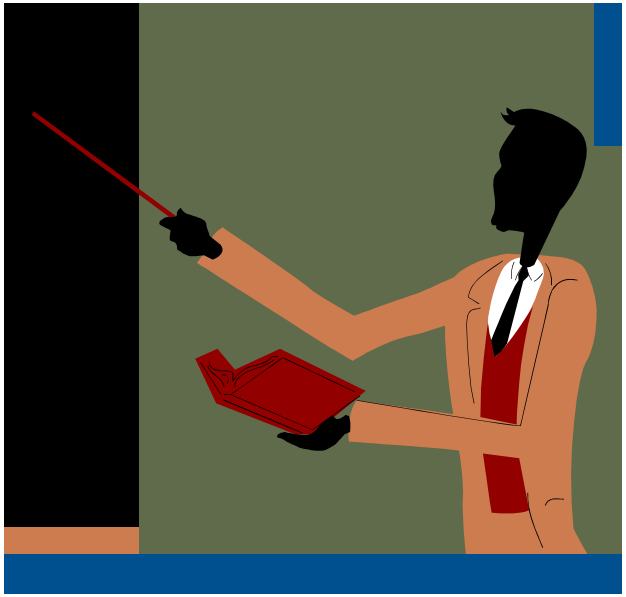
This session will cover the various interfaces to request data from the broker. This will include command line and programming interfaces to request status information, monitoring data publishing and message flow events.

By attending this session, you will be able to better understand your broker operation and function.

About the Speaker

- **Richard Nikula**
  - VP of Product Development and Support
  - Over 20 years experience with MQ, Broker and related technologies

- **About Nastel Technologies** **www.nastel.com**
  - Founded in 1994
  - Middleware-centric Application Performance Management software supplier
  - Core competency : Real-time monitoring and analytics, Messaging Middleware, Java Application Servers, ESB's and other SOA technologies
  - Details on our Message Broker solution are here: http://www.nastel.com/tech/middleware/websphere-message-broker.html



Disclaimers

- IBM periodically has changed the name of the Message Broker, from MQSI to WebSphere Message Broker, WebSphere Business Integrator, IBM Integration Bus, …
- In this session, we are specifically focused on the broker, whatever you call it…
- All topics are applicable to Version 7 and higher
- Most examples are from Version 8 but are applicable to Version 9
- Some examples included are from Nastel products but there are several methods to leverage this data and vendor products are not required.

Overview

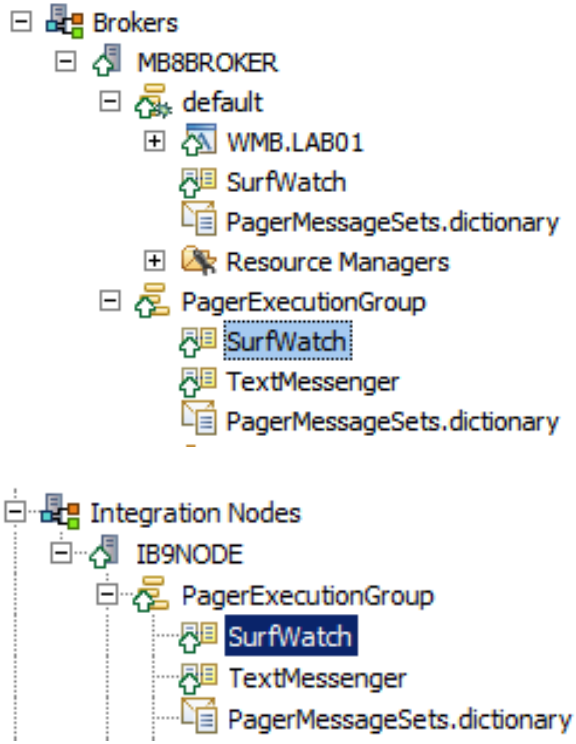
- Agenda
- Introduction to Broker Monitoring
- Resource Statistics
- Flow Statistics
- Broker Tracking
- Using the Statistics to monitor Broker Environments
- Conclusion

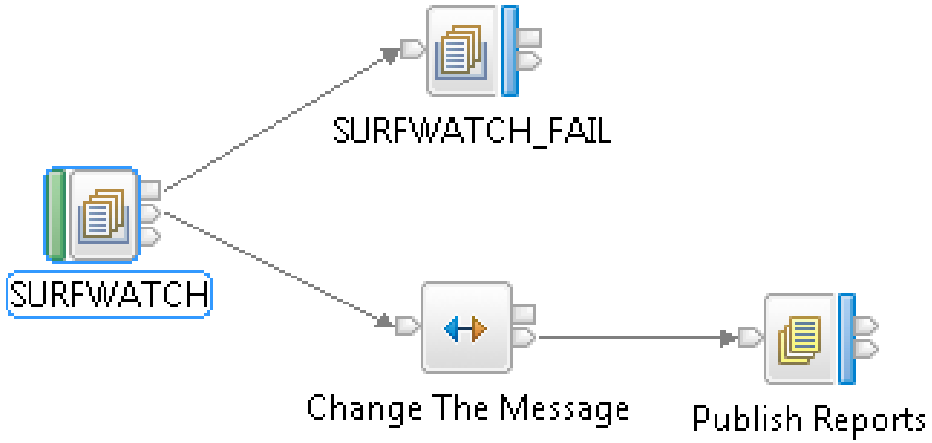
Key Broker Terms (as People know them)

- Broker – Routing and Transformation Engine supporting various protocols such as http, MQ and files
- Execution Group – a grouping of related Message Flows (processes) that provides isolation, performance allocation, and control
- Message Flow – A specific logical flow through the message broker which may include logic, transformation and routing.
- Threads – processing threads allocated to an Execution Group which execute the message flows
- Topic – A hierarchy that describes the context of a specific message
- Subscription – A request to receive posts to all or part of a topic hierarchy
- Queue Manager – An IBM (WebSphere) MQ service that provides the underlying technology for Message Broker. Required even if the broker does not use WMQ Message Flows

Simple Example

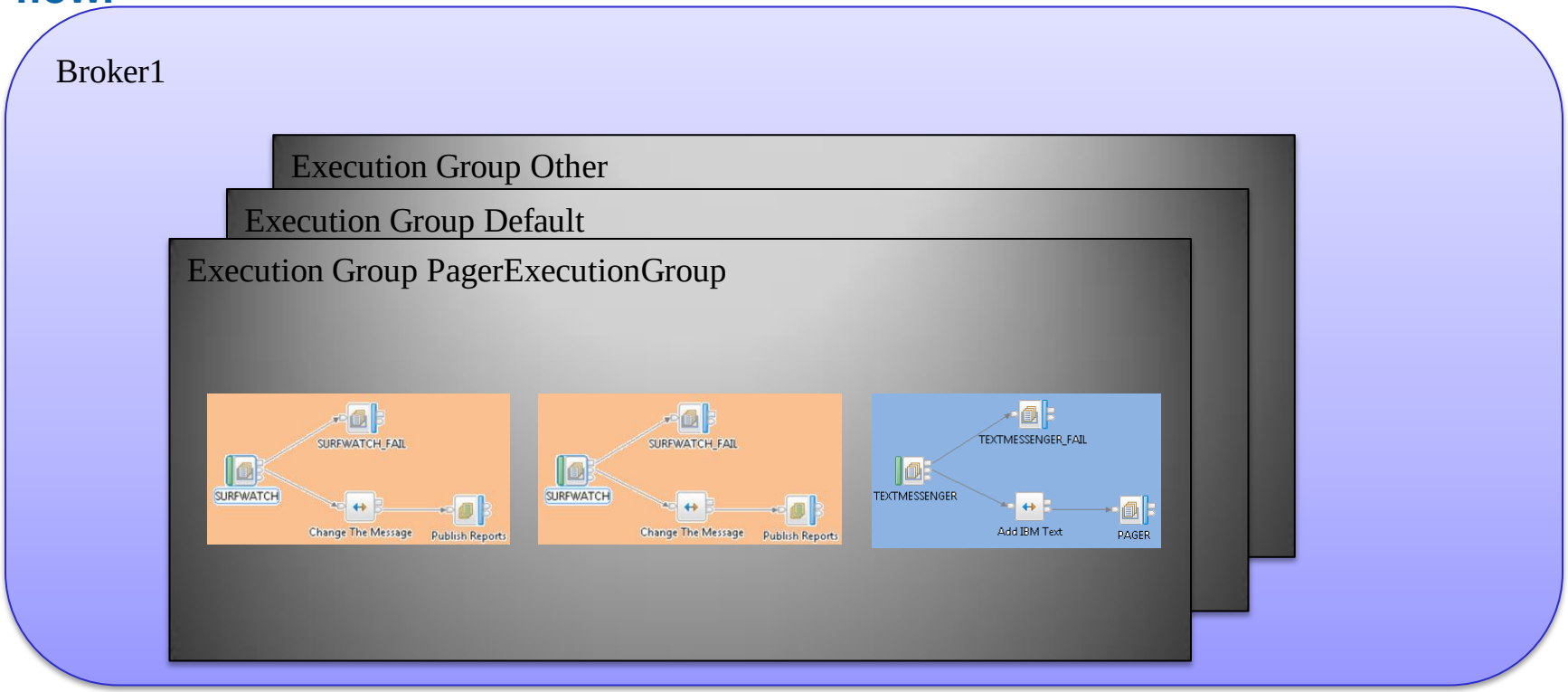
- This is one of the sample message flows that is shipped with the broker, which has a single input node , one transformation step, and an output. It also has a potential failure node.





Execution Example

- This example shows a broker with 3 execution groups, each running a set of message flows. One of the execution groups is running 2 instances (threads) of the sample Surfwatch flow, as well as a TextMessage message flow.



Why Monitor the broker?

- “Sub-optimal” configuration
- “Sub-optimal” Application Design
- Contention for broker resources
- Actual usage compared to intended usage
- Planning for future growth
- Tracking
- …

Broker Got Monitoring Right

- Integrated Monitoring
- Robust Statistics
- Dynamic Activation
- Multiple Collection Levels
- Consumers Subscribe / Broker Publishes
- Basic Monitoring Tools *

Type of Broker Management Data

- **Resource Statistics**
  - Resources used by execution groups
- **Monitoring Statistics**
  - Usage Statistics of execution groups, nodes and threads
- **Flow Tracking**
  - Tracking of execution flow through message flows

RESOURCE STATISTICS

Broker Resource Statistics

- **The broker provides detailed statistics**

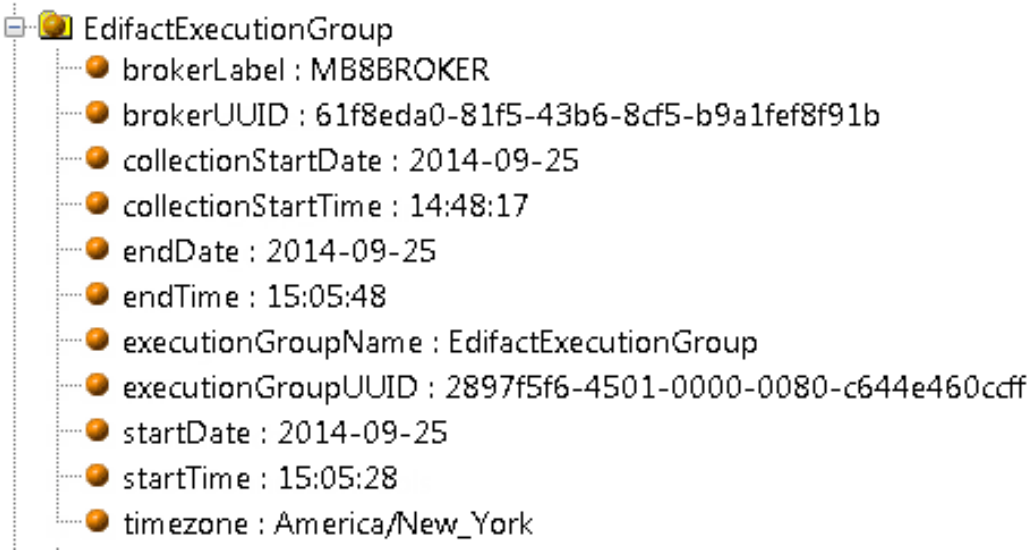
- **Base Data**
  - Collection Information

- **Extended Data by domain**
  - JVM
  - Parsers
  - DotNet
  - Security
  - JMS
  - FTE
  - JDBC
  - Sockets
  - Soap

- **Specific data for details varies by domain**

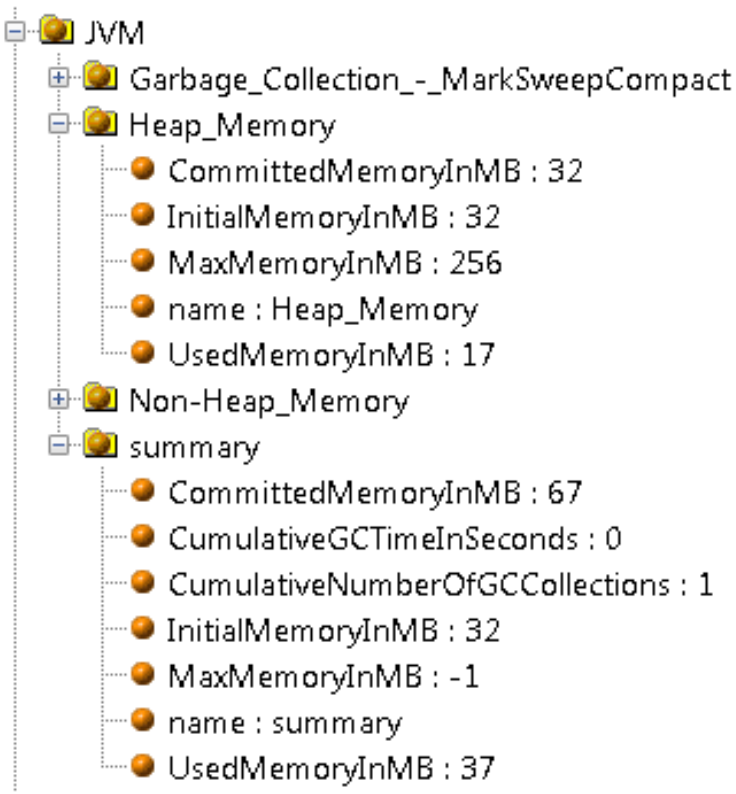
Sample Statistics (Base)

<ResourceStatistics brokerLabel="MB8BROKER" brokerUUID="61f8eda0-81f5-43b6-8cf5-b9a1fef8f91b" executionGroupName="EdifactExecutionGroup" executionGroupUUID="2897f5f6-4501-0000-0080-c644e460ccff" collectionStartDate="2014-09-10" collectionStartTime="19:09:43" startDate="2014-09-21" startTime="10:32:09" endDate="2014-09-21" endTime="10:32:29" timezone="America/New_York">



Sample Statistics (Detail)

```
<ResourceType name="JVM">
    <resourceIdentifier name="summary"
                InitialMemoryInMB="32"
                UsedMemoryInMB="63"
                CommittedMemoryInMB="92"
                MaxMemoryInMB="-1"
                CumulativeGCTimeInSeconds="0"
                CumulativeNumberOfGCCollections="40" />
   <resourceIdentifier name="Heap Memory"
                InitialMemoryInMB="32"
                UsedMemoryInMB="43"
                CommittedMemoryInMB="59"
                MaxMemoryInMB="256" />
   <resourceIdentifier name="Non-Heap Memory"
                InitialMemoryInMB="0"
                UsedMemoryInMB="20"
                CommittedMemoryInMB="33"
                MaxMemoryInMB="-1" />
…
```



Activating Resource Statistics

- mqsichangeresourcestats
- Collect for all or specific execution group
- Similar commands for distributed and z/OS
- Once Executed, set until reset
- Collection Interval is fixed at 20 seconds

mqsichangeresourcestats Examples

- mqsichangeresourcestats Broker -c active
- > Activate resource stats data collection for all execution groups

- mqsichangeresourcestats Broker -e EGRP -c active
- > Activate resource stats data collection for execution group EGRP

- mqsichangeresourcestats Broker -c inactive
- > Deactivate resource stats for everything

Turning on Collection is the First Step

- The resource statistics data is published

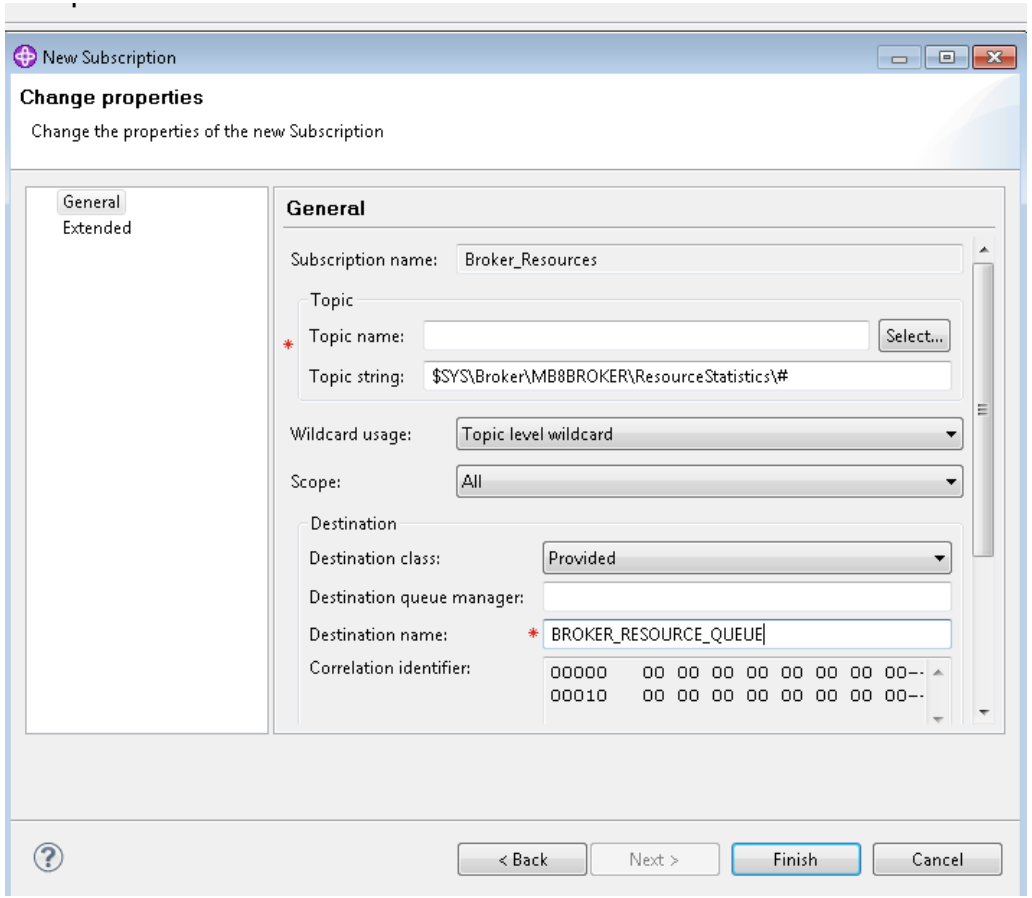
- **$SYS/Broker/***brokerName***/ResourceStatistics/***ExecutionGroup*

- Example Subscriptions
- $SYS/Broker/Broker1/ResourceStatistics/#
- $SYS/Broker/Broker2/ResourceStatistics/EGRP/#

The resultant data is then processed directly by a subscribing application or placed on a queue for processing by an application.

Sample Subscription

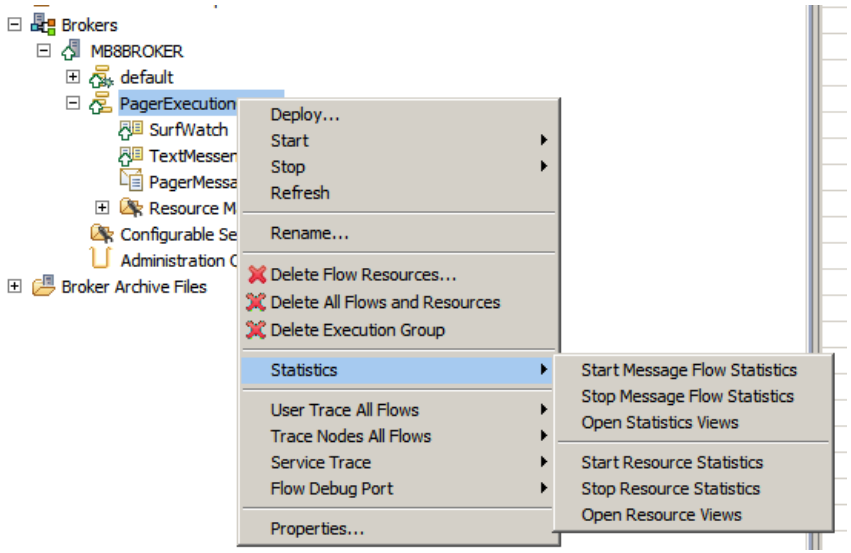
- Sample Broker Subscription

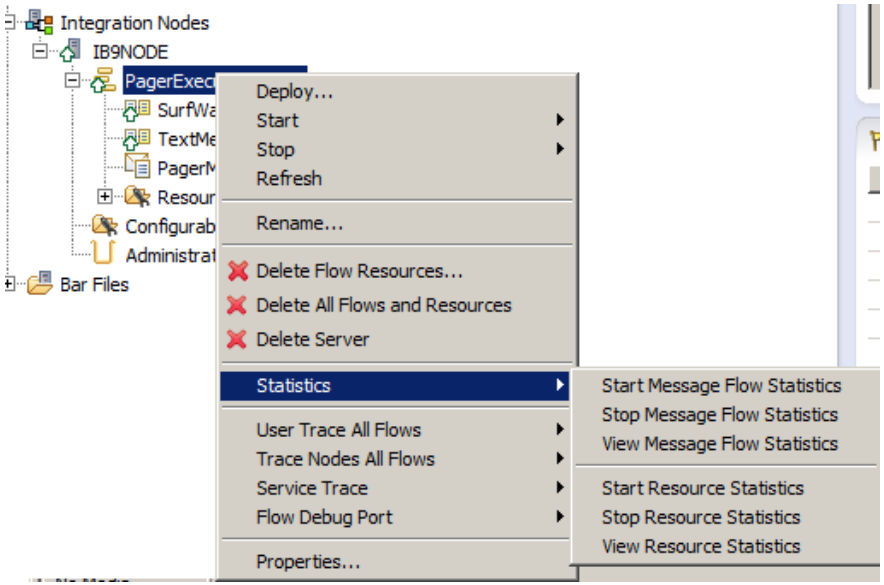


Resource Statistics Usage

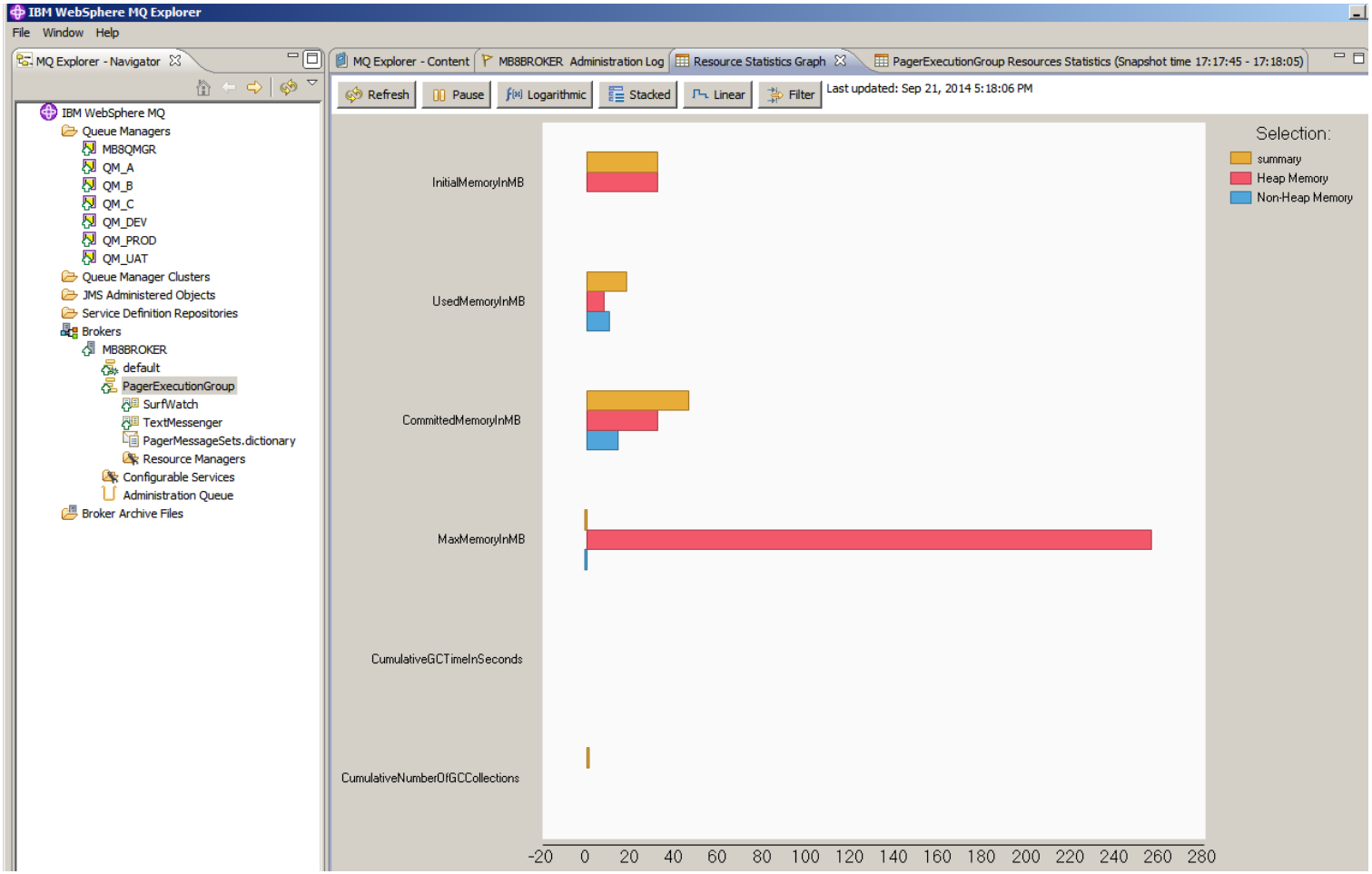
- **JVM**
  - Identify memory resource issues
  - Frequent Garage Collection
- **Parsers**
  - Identify Resource cost of a parser
  - Identify inefficient parser architecture
- **Sockets**
  - Traffic patterns
- **Other**
  - Based on domains used

Activating with Broker Explorer

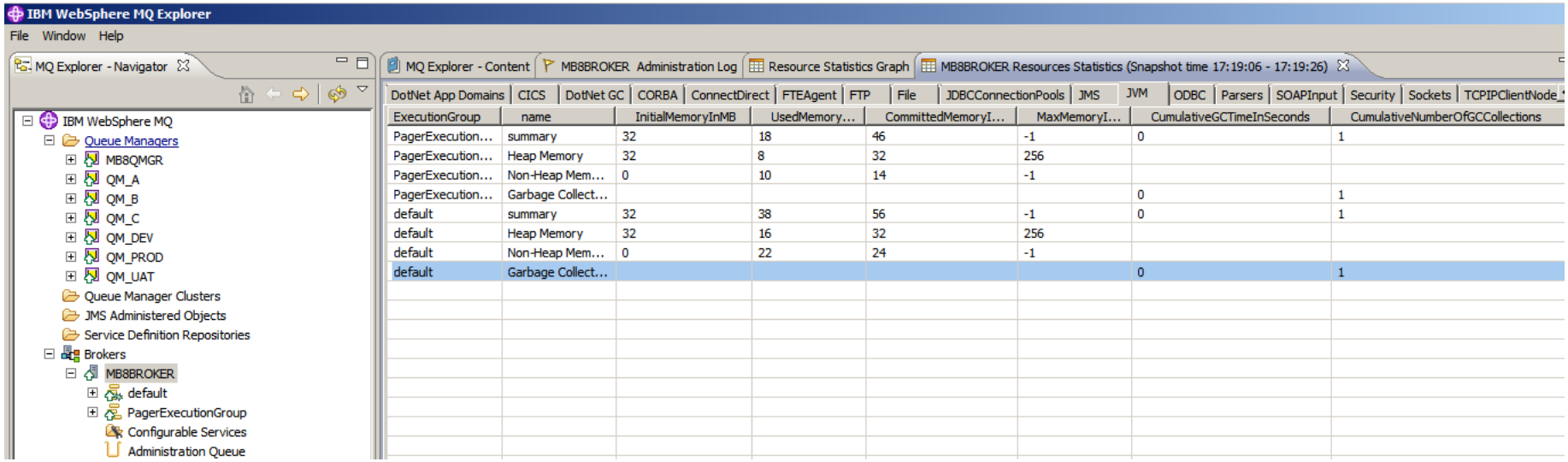




Displaying Resource Statistic Charts



Resource Statistics Details



MONITORING STATISTICS

Broker Monitoring Statistics

- **The broker provides detailed statistics**

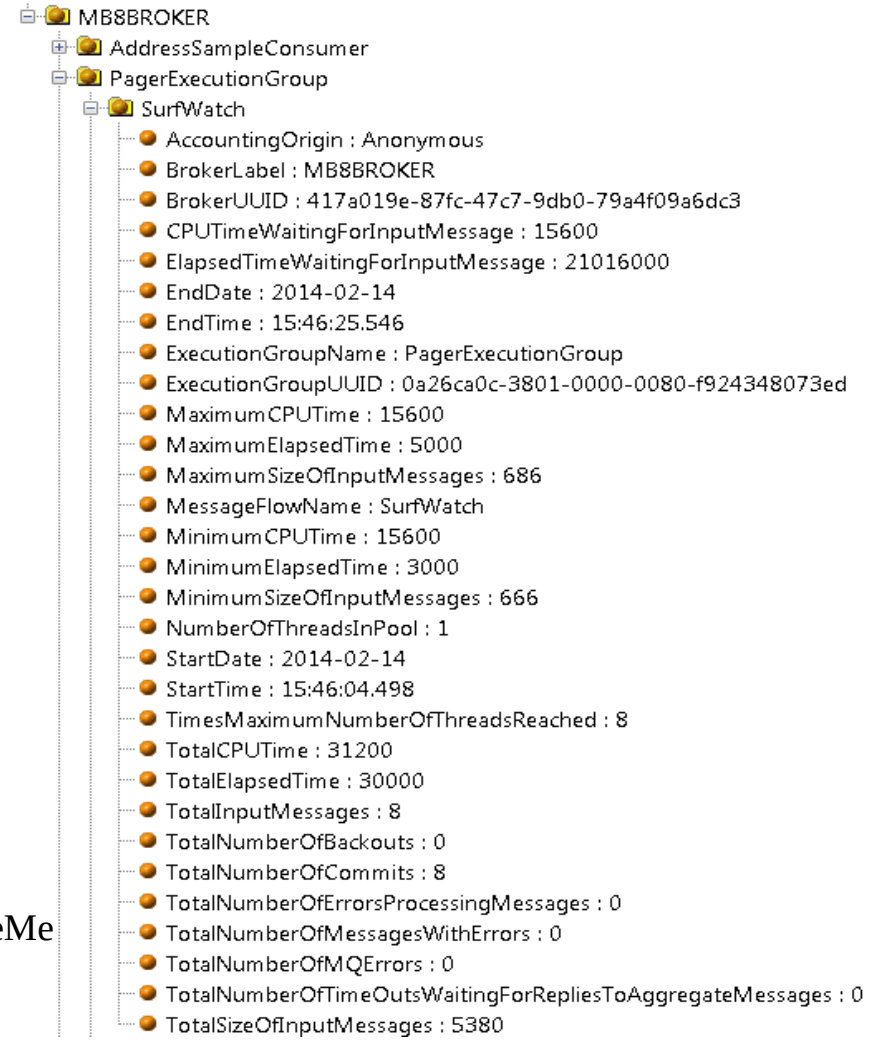
- **Message Flow Level (for the flow)**
  - Total Messages Processed
  - Total Messages in Error
  - CPU Time Spent
  - Message Statistics

- **Node Level (for each processing node)**
  - Invocations
  - CPU Time
  - Information

- **Thread Level (for each thread)**
  - Messages Processed
  - CPU Time Spent
  - Message Statistics

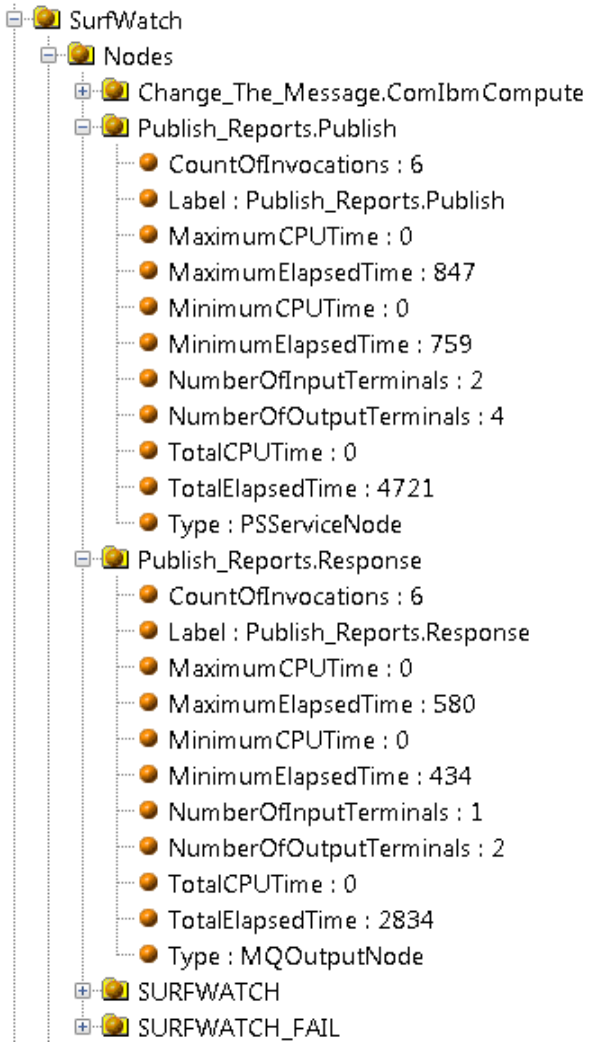
Message Flow Statistics

<MessageFlow BrokerLabel="MB8BROKER"
BrokerUUID="61f8eda0-81f5-43b6-8cf5-b9a1fef8f91b"
ExecutionGroupName="PagerExecutionGroup"
ExecutionGroupUUID="a4f0fff6-4501-0000-0080-
c644e460ccff" MessageFlowName="SurfWatch"
StartDate="2014-09-25" StartTime="15:31:49.312"
EndDate="2014-09-25" EndTime="15:32:09.312"
TotalElapsedTime="0" MaximumElapsedTime="0"
MinimumElapsedTime="0" TotalCPUTime="0"
MaximumCPUTime="0" MinimumCPUTime="0"
CPUTimeWaitingForInputMessage="0"
ElapsedTimeWaitingForInputMessage="19999758"
TotalInputMessages="0" TotalSizeOfInputMessages="0"
MaximumSizeOfInputMessages="0"
MinimumSizeOfInputMessages="0"
NumberOfThreadsInPool="1"
TimesMaximumNumberOfThreadsReached="0"
TotalNumberOfMQErrors="0"
TotalNumberOfMessagesWithErrors="0"
TotalNumberOfErrorsProcessingMessages="0"
TotalNumberOfTimeOutsWaitingForRepliesToAggregateMe
ssages="0" TotalNumberOfCommits="0"
TotalNumberOfBackouts="0"
AccountingOrigin="Anonymous" />



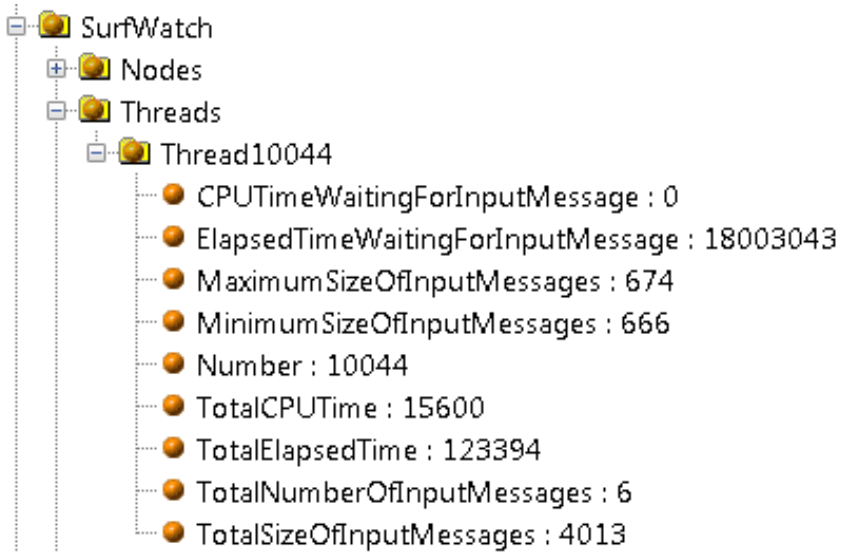
Node Statistics

<Nodes Number="**5**">
<NodeStatistics Label="**Change The Message.ComIbmCompute**" Type="**ComputeNode**" TotalElapsedTime="**2724**" MaximumElapsedTime="**465**" MinimumElapsedTime="**448**" TotalCPUTime="**0**" MaximumCPUTime="**0**" MinimumCPUTime="**0**" CountOfInvocations="**6**" NumberOfInputTerminals="**1**" NumberOfOutputTerminals="**6**" />
<NodeStatistics Label="**Publish Reports.Publish**" Type="**PSServiceNode**" TotalElapsedTime="**4751**" MaximumElapsedTime="**808**" MinimumElapsedTime="**773**" TotalCPUTime="**0**" MaximumCPUTime="**0**" MinimumCPUTime="**0**" CountOfInvocations="**6**" NumberOfInputTerminals="**2**" NumberOfOutputTerminals="**4**" />
<NodeStatistics Label="**Publish Reports.Response**" Type="**MQOutputNode**" TotalElapsedTime="**961**" MaximumElapsedTime="**167**" MinimumElapsedTime="**157**" TotalCPUTime="**0**" MaximumCPUTime="**0**" MinimumCPUTime="**0**" CountOfInvocations="**6**" NumberOfInputTerminals="**1**" NumberOfOutputTerminals="**2**" />



Thread Level Statistics

<Threads Number="**1**">
<ThreadStatistics Number="**10044**"
TotalNumberOfInputMessages="**6**"
TotalElapsedTime="**47679**" TotalCPUTime="**15600**"
CPUTimeWaitingForInputMessage="**0**"
ElapsedTimeWaitingForInputMessage="**18003043**"
TotalSizeOfInputMessages="**4013**"
MaximumSizeOfInputMessages="**674**"
MinimumSizeOfInputMessages="**666**" />
</Threads>



Activating Statistics Collection

- mqsichangeflowstats

- Collect for all or specific flows
- Collect Node level statistics (optional)
- Collect Thread level statistics (optional)

- Similar commands for distributed and z/OS

- Once Executed, set until reset
- 2 forms

- Snapshot – 20 second sample
- Archive – longer term sample (default 60 minutes)

mqsichangeflowstats Examples

- mqsichangeflowstats Broker -s -g -j -c active
- > Activate snapshot data collection for all execution groups and flows (with the last options previously set)

- mqsichangeflowstats Broker -a -g -j –n basic -c active
- > Activate archive data collection for all execution groups and flows including basic node level statistics

- mqsichangeflowstats Broker -a -e EGRP -f MyFlow1 -c active -t basic
- > Activate archive data collection for execution group EGRP and only flow MyFlow1 include basic thread statistics

- mqsichangeflowstats Broker -s -g -j -c inactive
- > Deactivate snapshot data collection for everything

Some Notable Options

-r Resets the archive interval

-k Application name for fine-grain analysis

-o json Output is sent using JSON format (unique topics)

smf zOS, written as SMF type 117

usertrace written to log files for post processing

xml xml formatted

Turning on Collection is the First Step

- **The statistics data is published**

- $**SYS/Broker**/*brokerName*/**StatisticsAccounting**/*recordType*/*executionGroupLabel*/*messageFlowLabel*
- **$SYS/Broker/***brokerName***/Statistics/JSON/SnapShot/…**

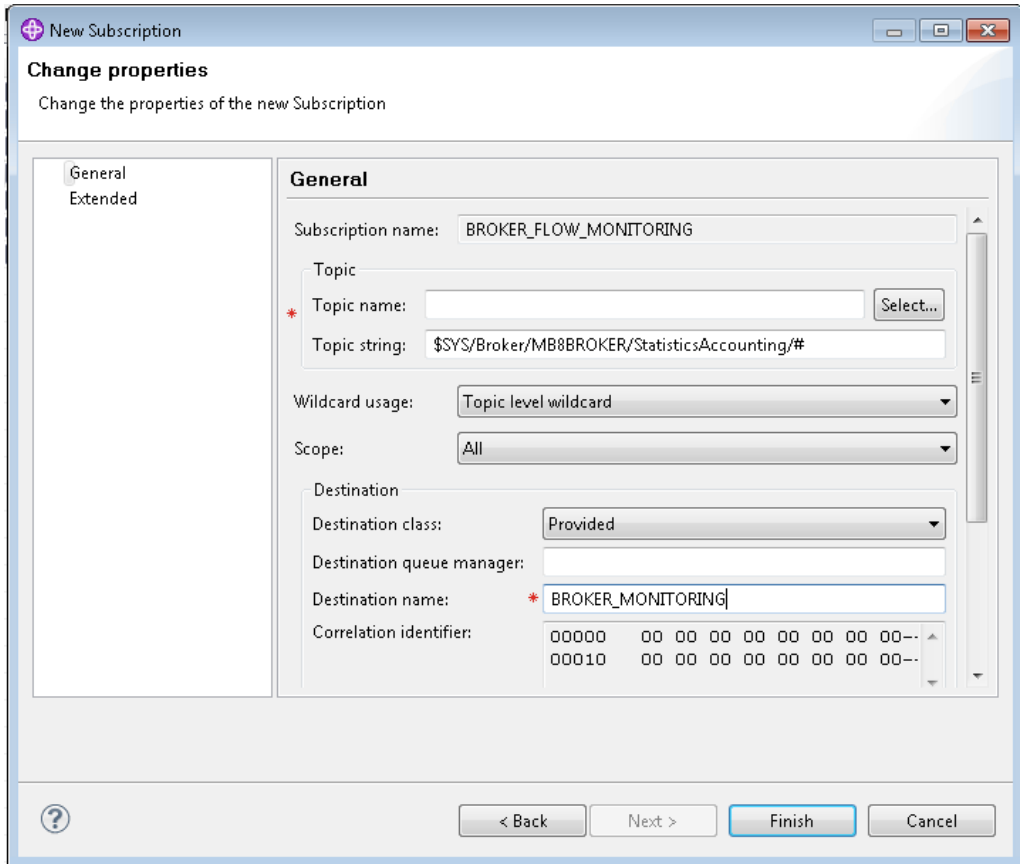
- **Example Subscriptions**

- **$SYS/Broker/Broker1/StatisticsAccounting/#**
- **$SYS/Broker/+/StatisticsAccounting/SnapShot/#**
- **$SYS/Broker/Broker2/StatisticsAccounting/+/EGRP/#**

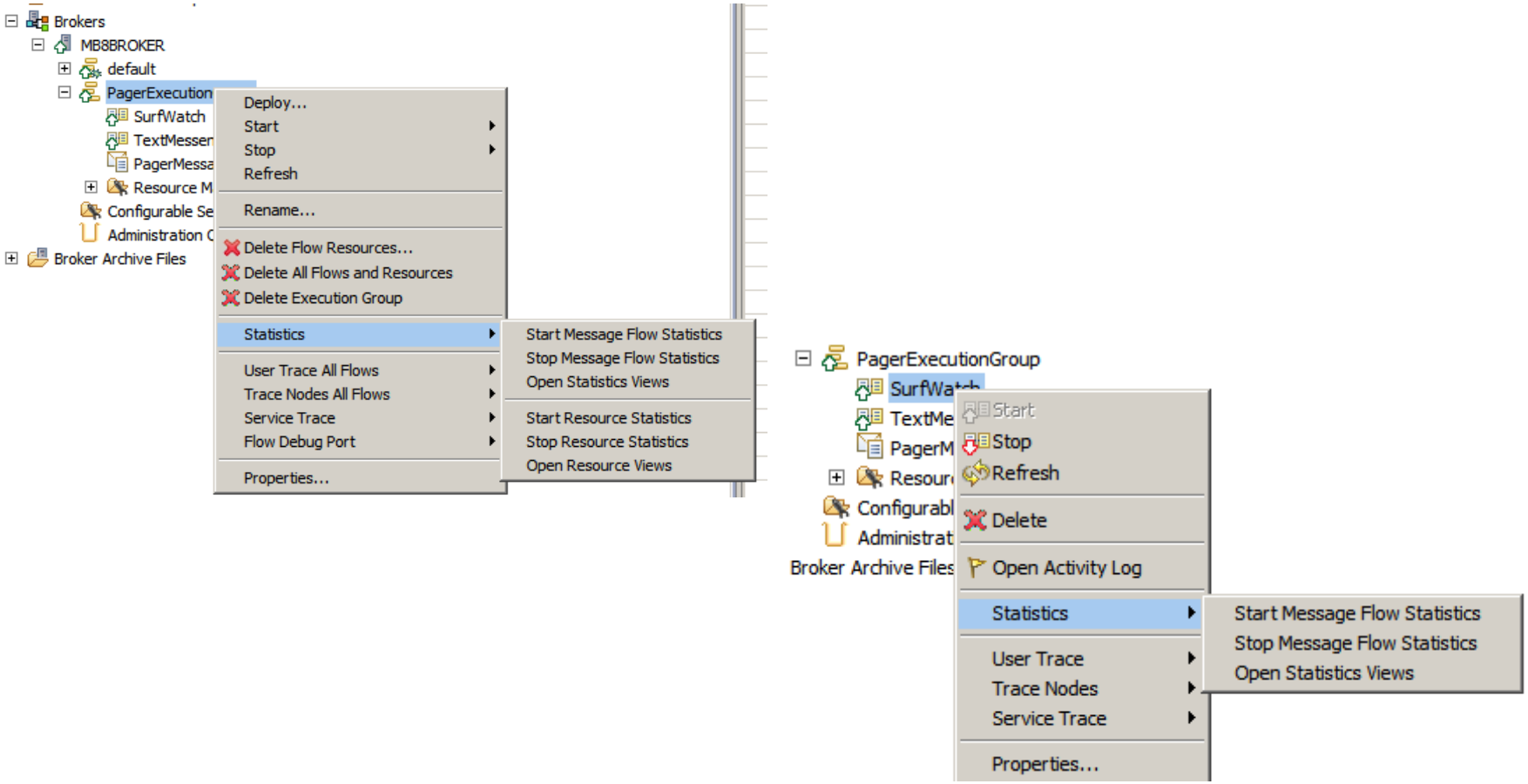
The resultant data is then processed directly by a subscribing application or placed on a queue for processing by an application.

Sample Subscription

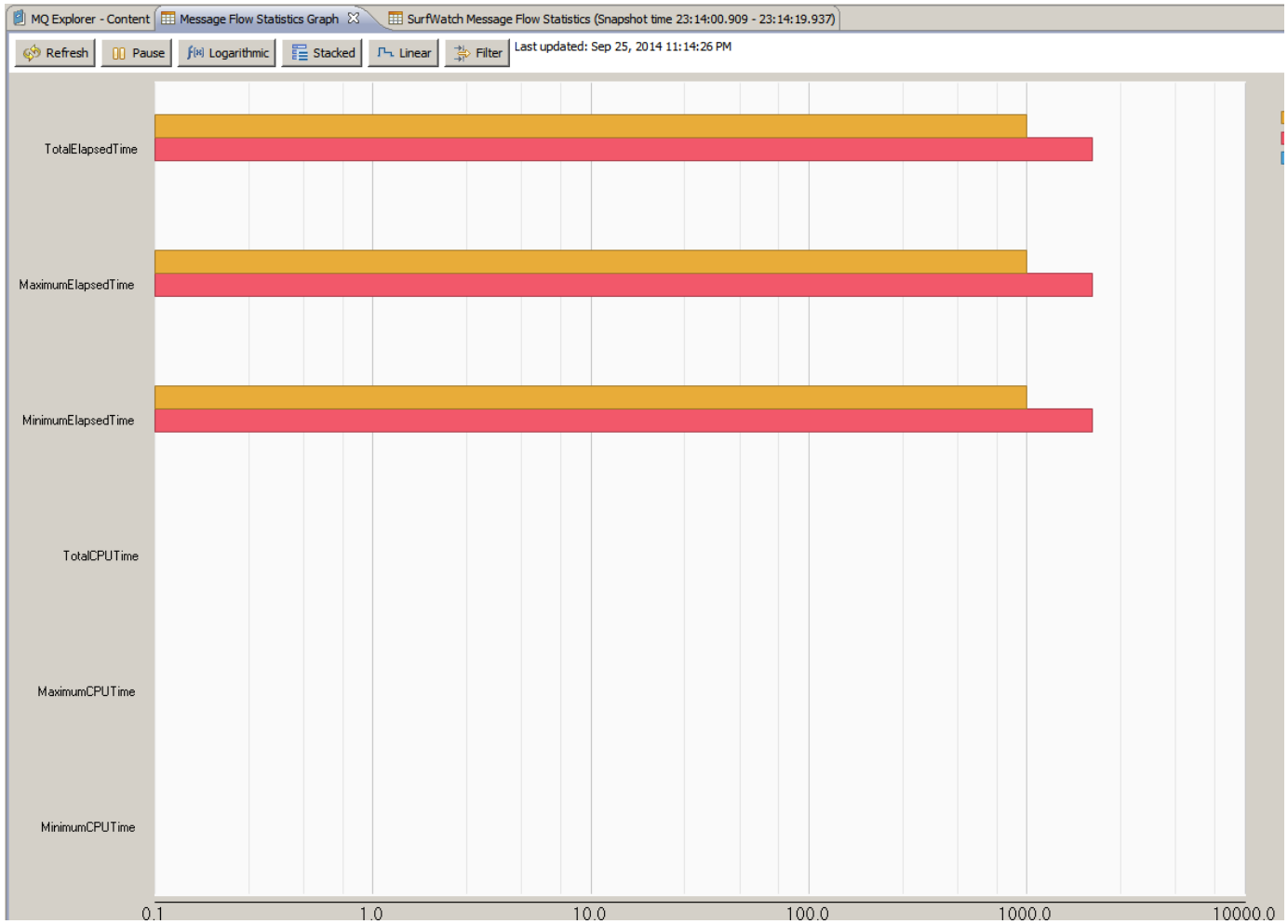
- Sample Monitoring Statistics Subscription



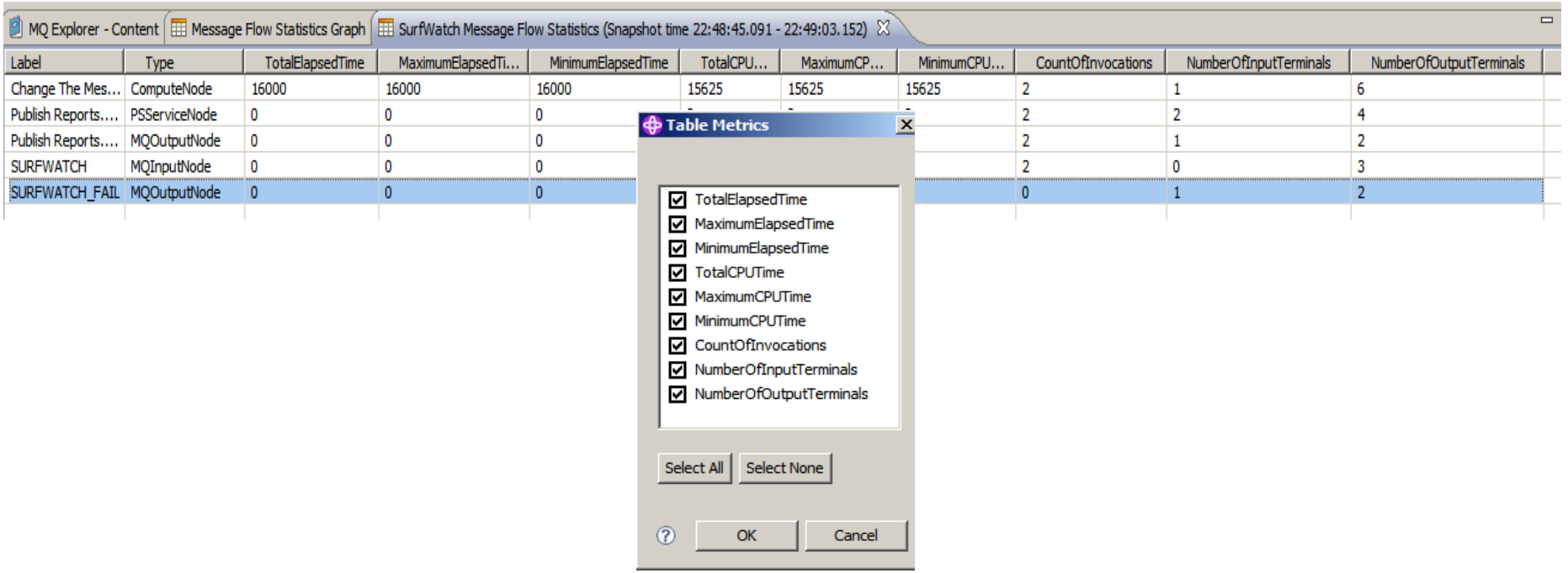
Activating with Broker Explorer



Flow Statistics Charts



Flow Statistics Details



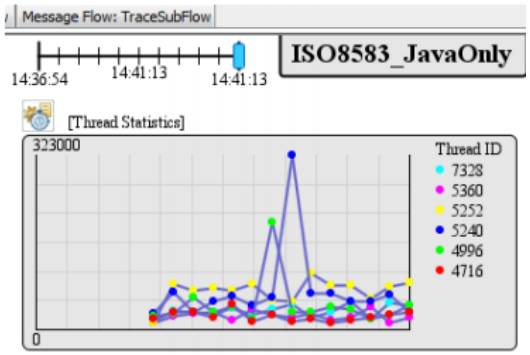
Snapshot to File

Snapshot time	2014-09-25	23:13:40.849	-	2014-09-25	23:14:00.909			
Broker	MB8BROKER							
Execution Group	PagerExecutionGroup							
Flow	SurfWatch							
Label	Type	TotalElapsedTime	MaximumElapsedTime		MinimumElapsedTime		TotalCPUTime	
	MaximumCPUTime	MinimumCPUTime	CountOfInvocations	NumberOfInputTerminals		NumberOfOutputTerminals		
Change The Message.	ComIbmCompute	ComputeNode	0	0	0	0	0	0
	3	1	6					
Publish Reports.Publish		PSServiceNode	0	0	0	0	0	0
	3	2	4					
Publish Reports.Response		MQOutputNode	0	0	0	0	0	0
	3	1	2					
SURFWATCH	MQInputNode	0	0	0	0	0	0	3
	0	3						
SURFWATCH_FAIL	MQOutputNode	0	0	0	0	0	0	0
	1	2						

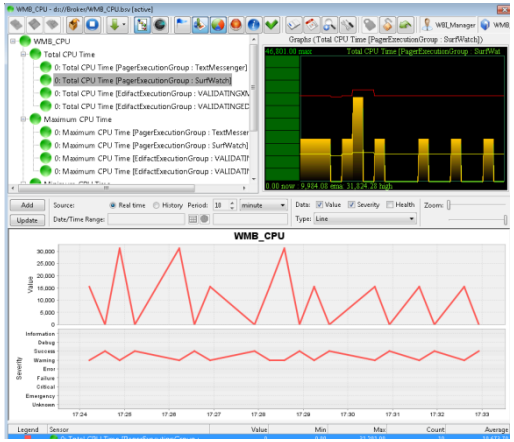
Snapshot time	2014-09-25	23:14:00.909	-	2014-09-25	23:14:19.937			
Broker	MB8BROKER							
Execution Group	PagerExecutionGroup							
Flow	SurfWatch							
Label	Type	TotalElapsedTime	MaximumElapsedTime		MinimumElapsedTime		TotalCPUTime	
	MaximumCPUTime	MinimumCPUTime	CountOfInvocations	NumberOfInputTerminals		NumberOfOutputTerminals		
Change The Message.	ComIbmCompute	ComputeNode	1000	1000	1000	0	0	0
	4	1	6					
Publish Reports.Publish		PSServiceNode	2000	2000	2000	0	0	0
	4	2	4					
Publish Reports.Response		MQOutputNode	0	0	0	0	0	0
	4	1	2					
SURFWATCH	MQInputNode	1000	1000	1000	0	0	0	4
	0	3						
SURFWATCH_FAIL	MQOutputNode	0	0	0	0	0	0	0
	1	2						

Capture and Display

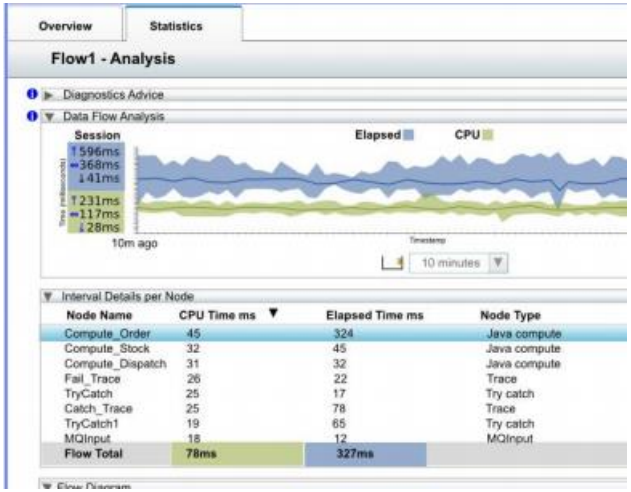
IS03



Via 3rd Party Products



Web Visualization and Analytics



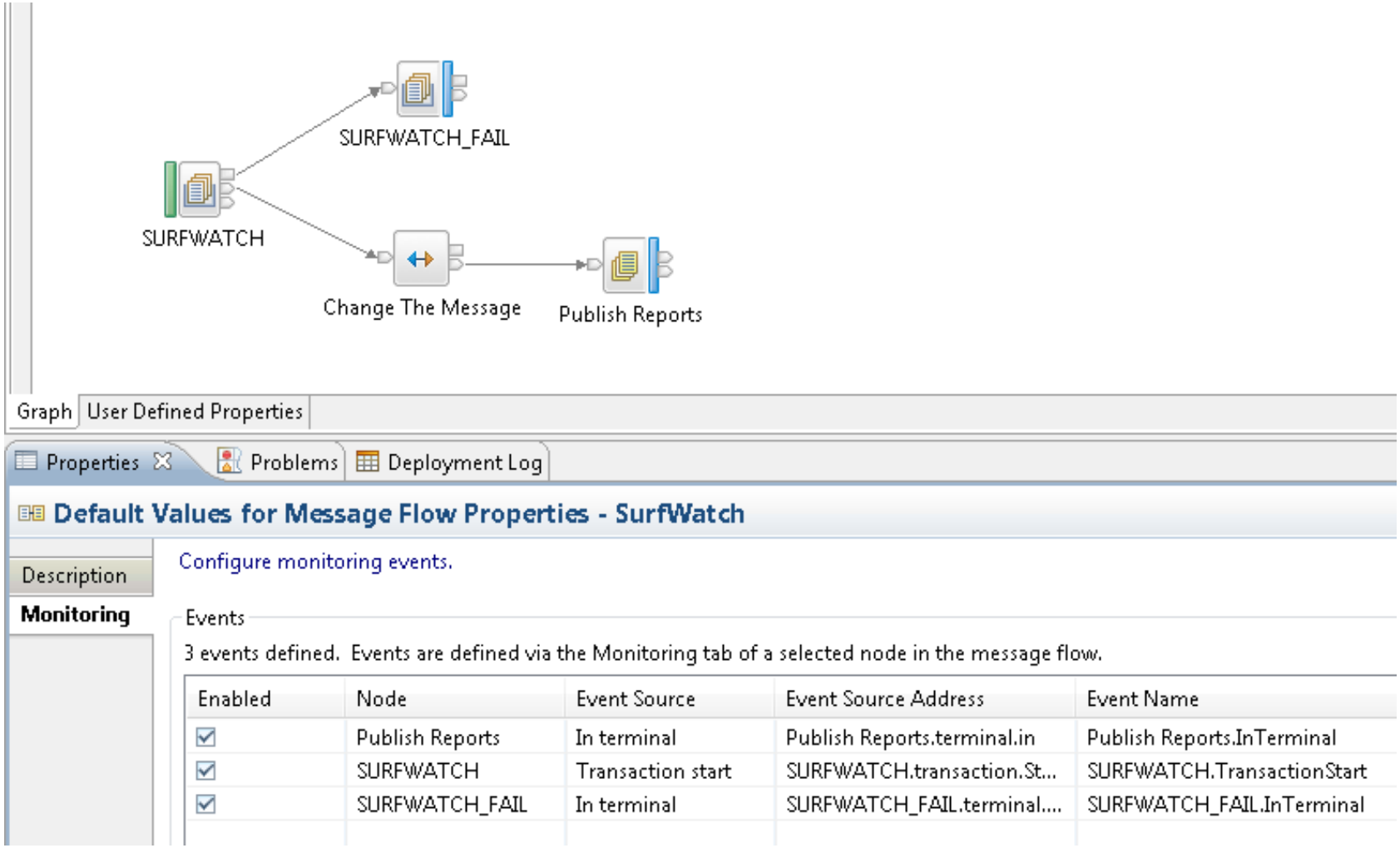
FLOW MONITORING

Tracking within the Message Flows

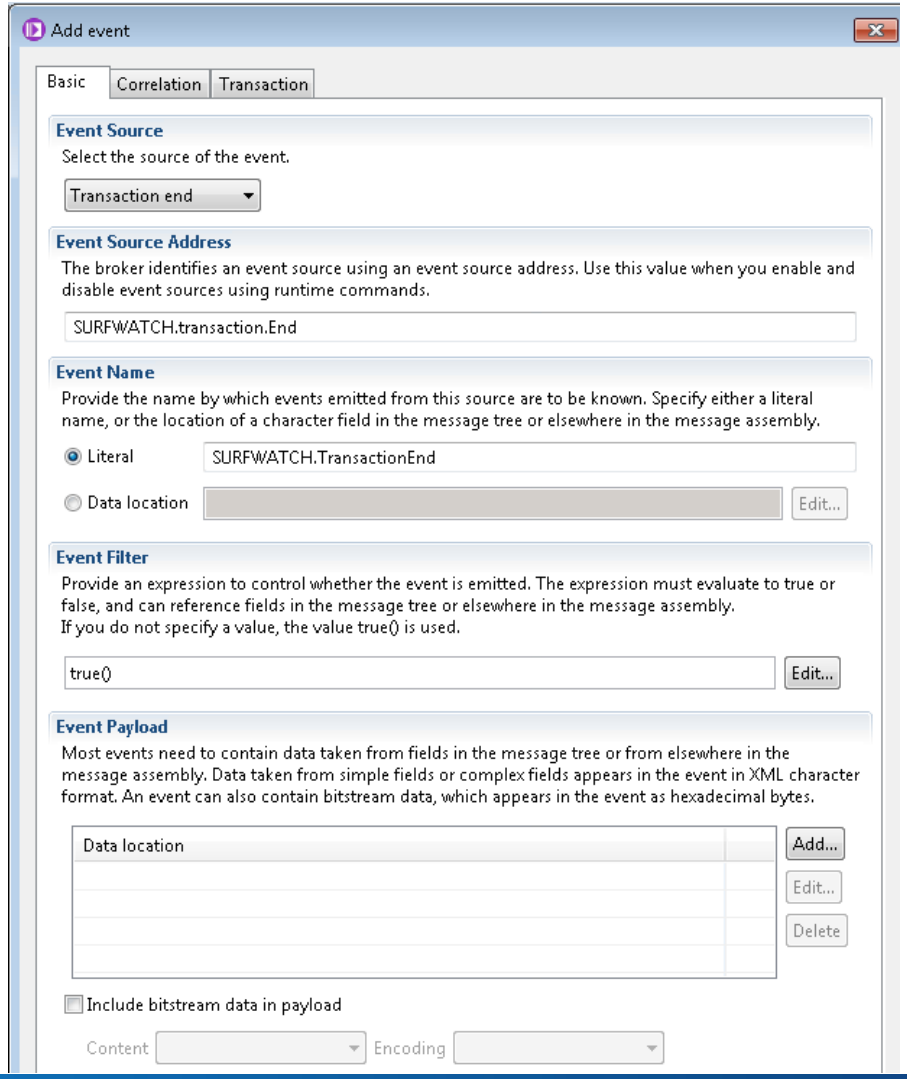
- The Broker Supports Tracking within the Message Flows
  - Transaction Start / Stop (default)
  - See when a given node was processed
  - See details about the message being processed by the flow
  - Track message flows in and across brokers

- Activated at the Message Flow and Node Level
  - Whether to collect
  - Data to Collect

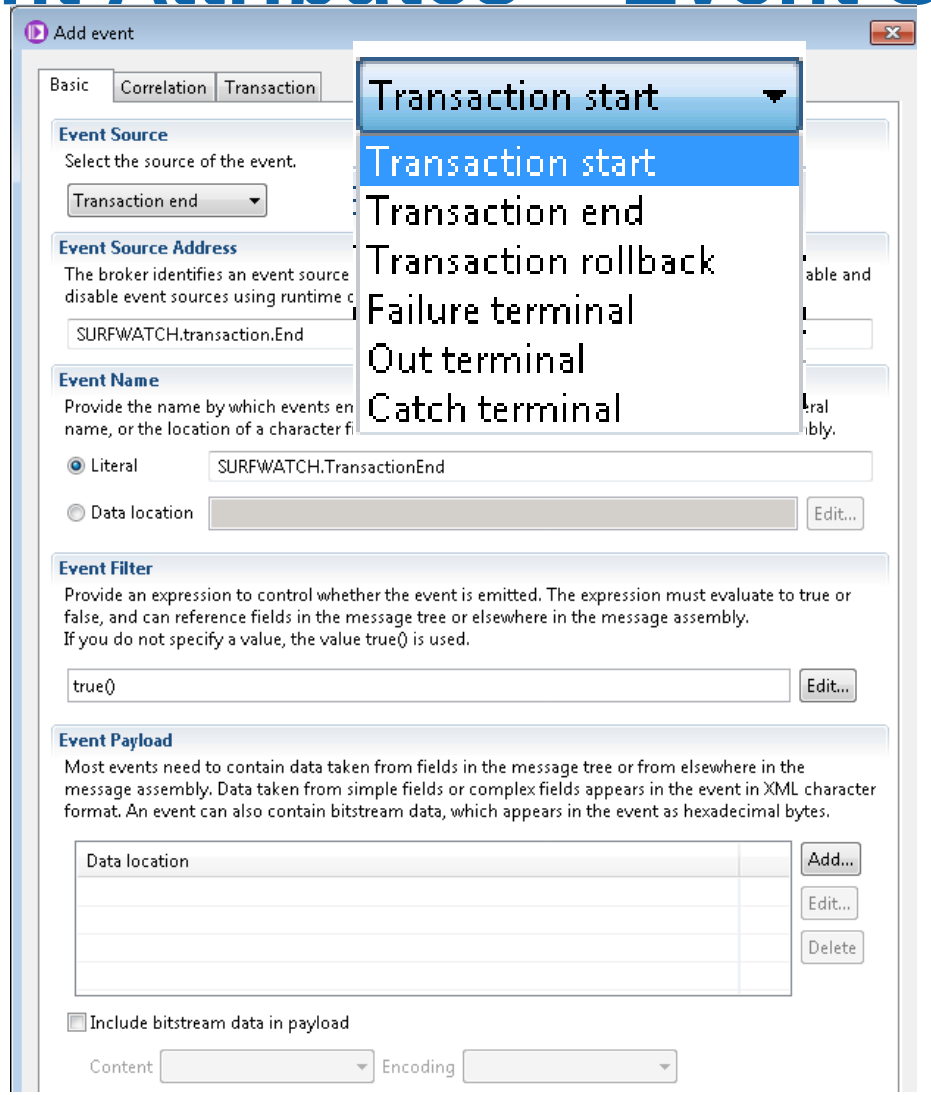
Configuring Message Flow Events



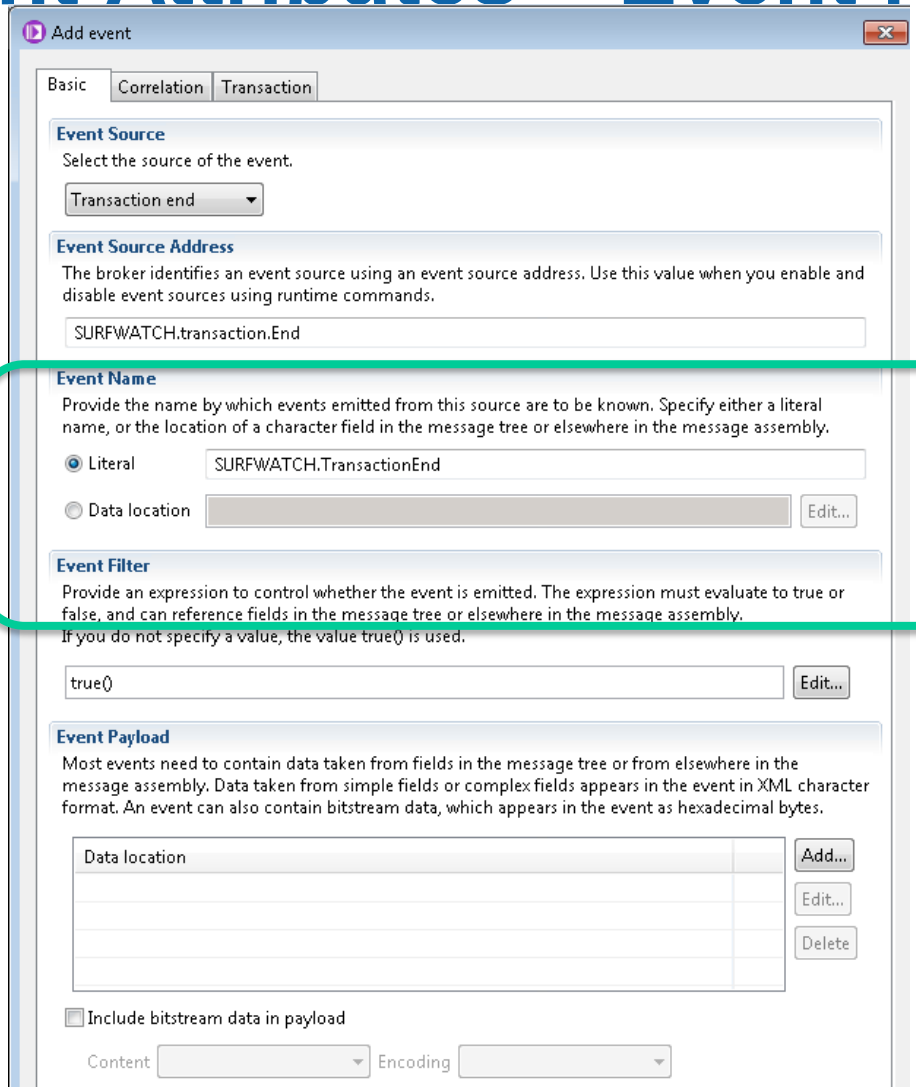
Event Attributes – Basic



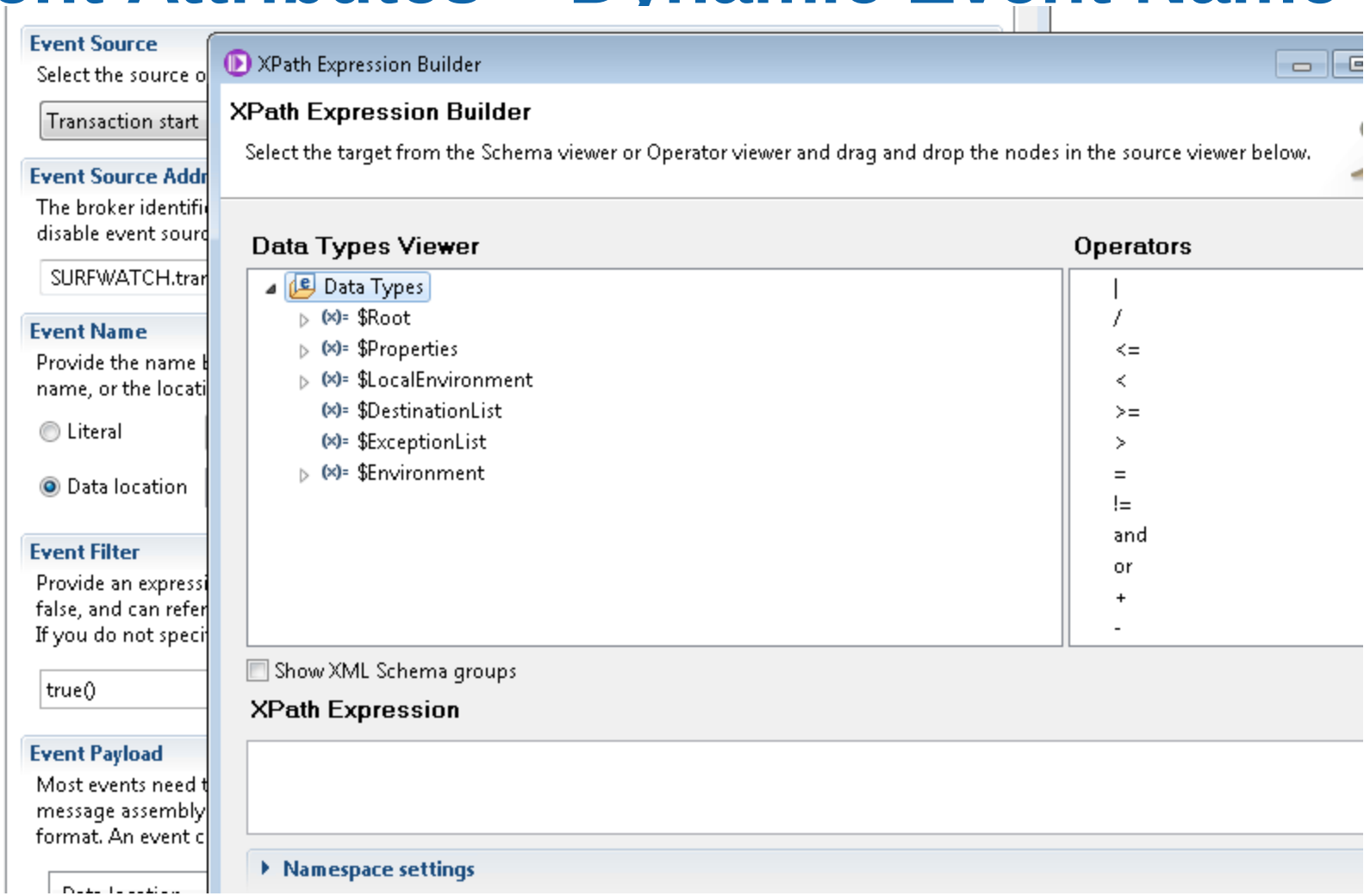
Event Attributes – Event Source



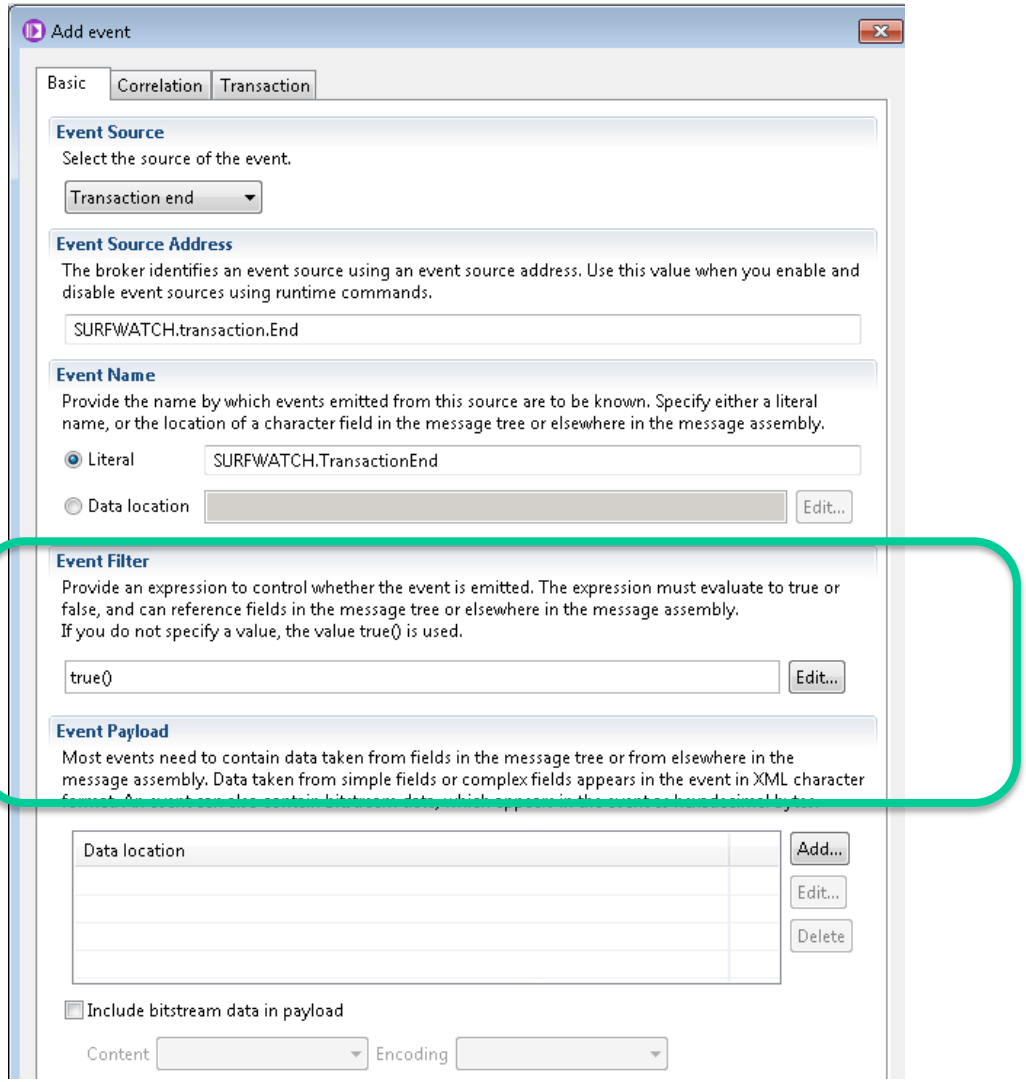
Event Attributes – Event Name



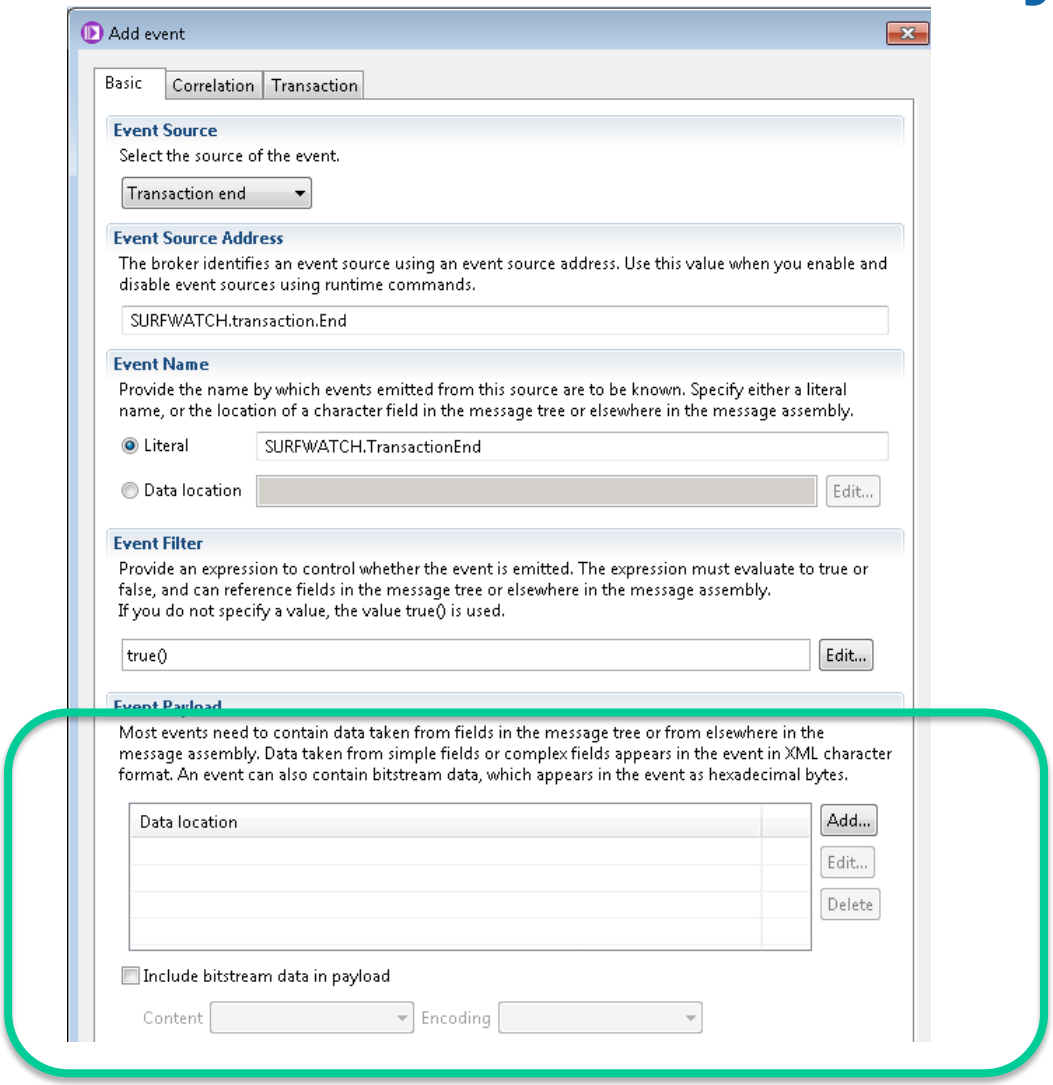
Event Attributes – Dynamic Event Name



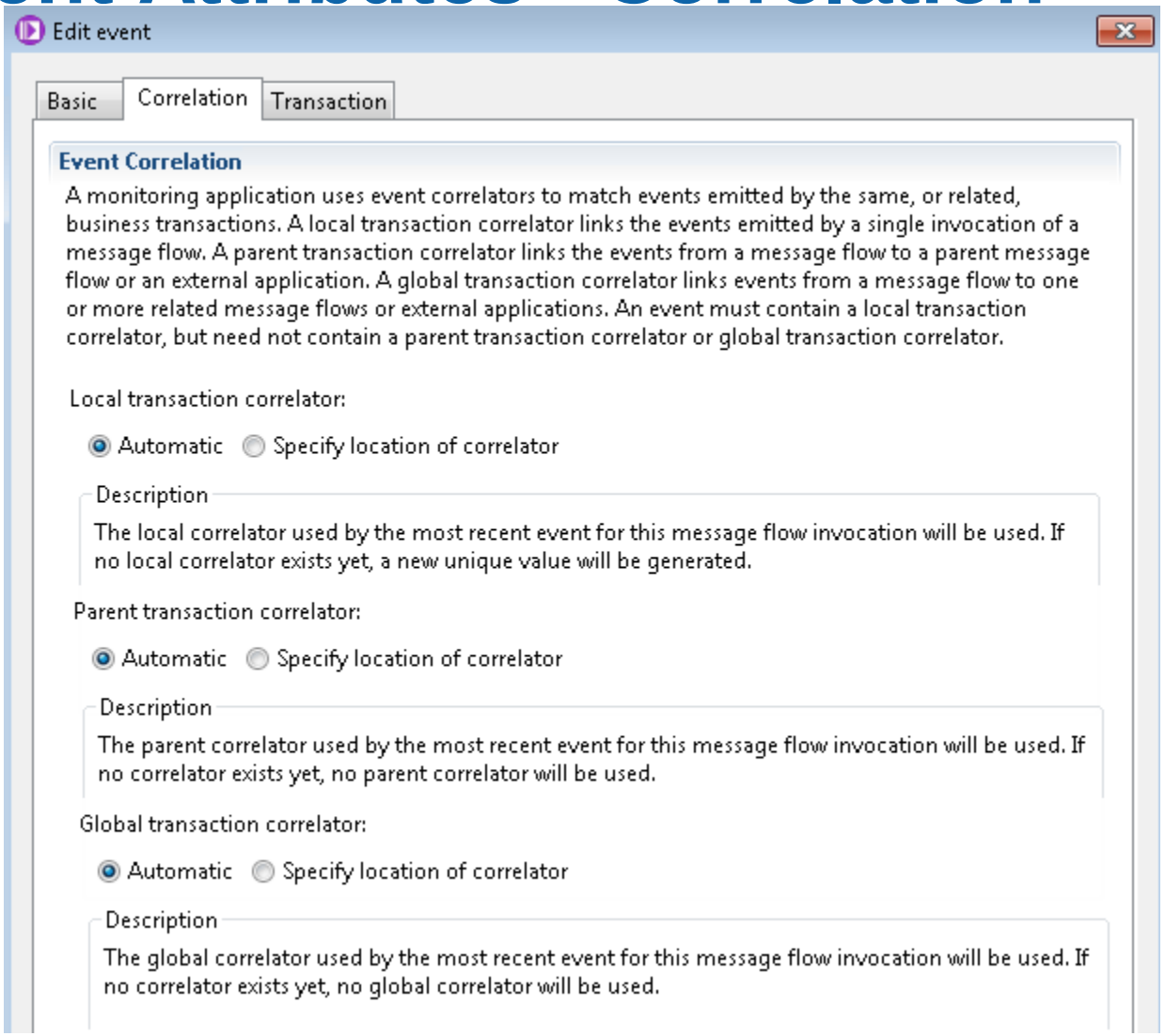
Event Attributes – Event Filter



Event Attributes – Event Payload



Event Attributes - Correlation



mqsichangeflowmonitoring Examples

- mqsichangeflowmonitoring BROKER -c active -g –j
- > Activate event flow monitoring for all execution groups and flows

- mqsichangeflowmonitoring BROKER -c active -e default -k application1 -f myflow1
- > Activate monitoring for message flow *myflow1* referenced by application *application1*, in execution group *default*

- mqsichangeflowmonitoring BROKER -c inactive -g –j
- > Deactivate event flow monitoring for everything

Getting Tracking Data

- The statistics Tracking data is published

- $SYS/Broker/<brokerName>/Monitoring/<executionGroupName>/<flowName>

- Example Subscriptions

- $SYS/Broker/Broker1/Monitoring/#
- $SYS/Broker/+/Monitoring/#
- $SYS/Broker/Broker2/Monitoring/EGRP/Flow1

The resultant data is then processed directly by a subscribing application or placed on a queue for processing by an application.

Tracking Data

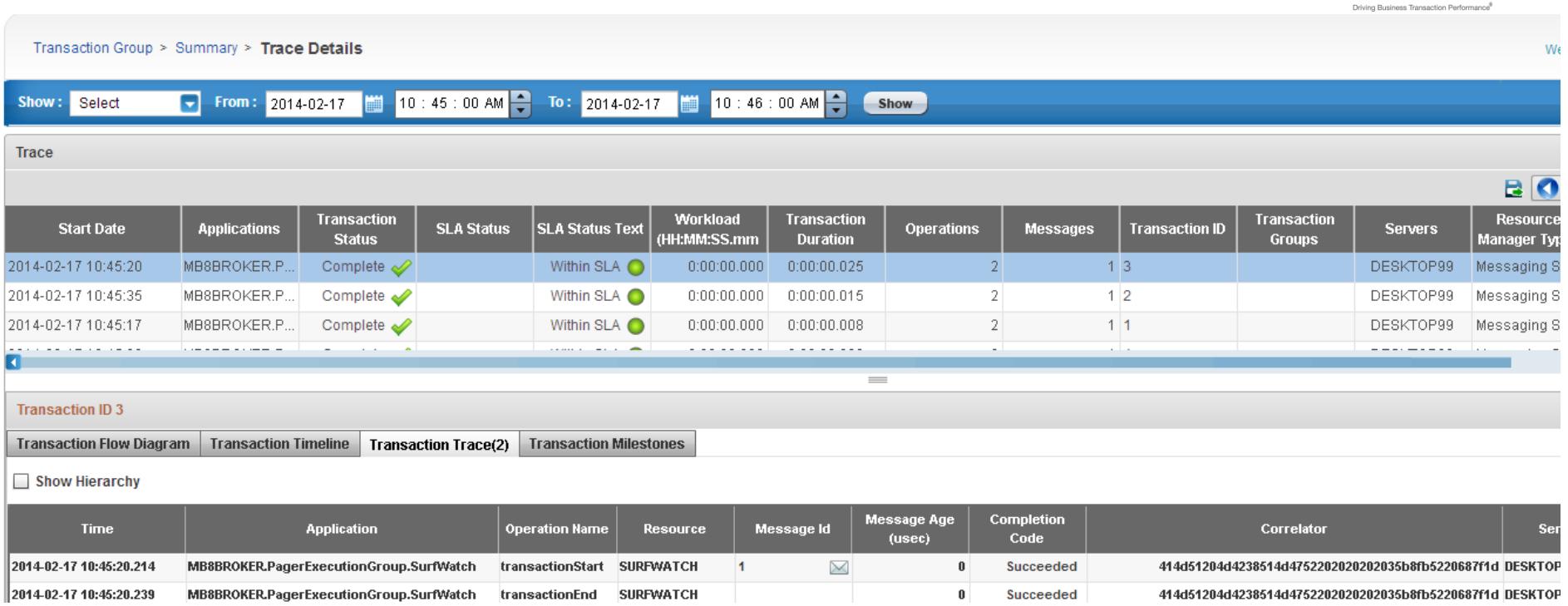
```
<wmb:event xmlns:wmb="http://www.ibm.com/xmlns/prod/websphere/messagebroker/6.1.0/monitoring/event">
<wmb:eventPointData>
<wmb:eventData wmb:productVersion="8001" wmb:eventSchemaVersion="6.1.0.2">
  <wmb:eventIdentity wmb:eventName="transactionStart" />
  <wmb:eventSequence wmb:creationTime="2014-09-25T21:06:10.008Z" wmb:counter="1" />
  <wmb:eventCorrelation wmb:localTransactionId="414d51204d4238514d47522020202020bf172454201458fe"
                wmb:parentTransactionId="" wmb:globalTransactionId="" />
  </wmb:eventData>
<wmb:messageFlowData>
  <wmb:broker wmb:name="MB8BROKER" wmb:UUID="61f8eda0-81f5-43b6-8cf5-b9a1fef8f91b" />
  <wmb:executionGroup wmb:name="PagerExecutionGroup"
                wmb:UUID="a4f0fff6-4501-0000-0080-c644e460ccff" />
  <wmb:messageFlow wmb:uniqueFlowName="MB8BROKER.PagerExecutionGroup.SurfWatch"
                wmb:name="SurfWatch" wmb:UUID="6c0000f7-4501-0000-0080-d6b3e1d5c115"
                wmb:threadId="10044" />
  <wmb:node wmb:nodeLabel="SURFWATCH" wmb:nodeType="ComIbmMQInputNode"
                wmb:detail="SURFWATCH" />
  </wmb:messageFlowData>
  </wmb:eventPointData>
</wmb:event>
```

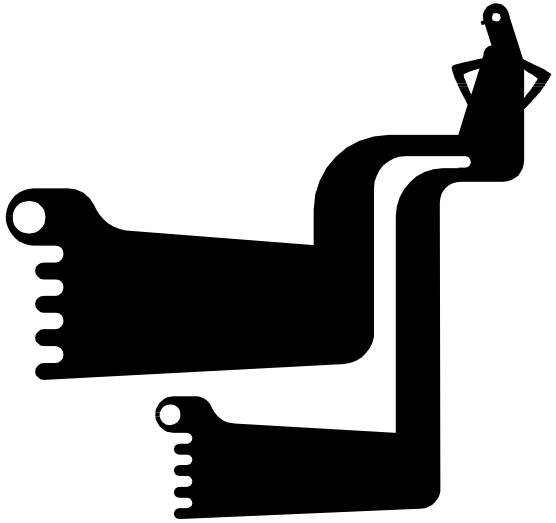
Tracking Data

```
<wmb:event
xmlns:wmb="http://www.ibm.com/xmlns/prod/websphere/messagebroker/6.1.0/monitoring/event">
<wmb:eventPointData>
  <wmb:eventData wmb:productVersion="8001" wmb:eventSchemaVersion="6.1.0.2">
   <wmb:eventIdentity wmb:eventName="transactionEnd" />
   <wmb:eventSequence wmb:creationTime="2014-09-25T21:06:48.273998Z" wmb:counter="2" />
   <wmb:eventCorrelation wmb:localTransactionId=" 414d51204d4238514d47522020202020bf172454201458fe "
                wmb:parentTransactionId="" wmb:globalTransactionId="" />
   </wmb:eventData>
   <wmb:messageFlowData>
   <wmb:broker wmb:name="MB8BROKER" wmb:UUID="61f8eda0-81f5-43b6-8cf5-b9a1fef8f91b" />
   <wmb:executionGroup wmb:name="PagerExecutionGroup"
                wmb:UUID="a4f0fff6-4501-0000-0080-c644e460ccff" />
   <wmb:messageFlow wmb:uniqueFlowName="MB8BROKER.PagerExecutionGroup.SurfWatch"
                wmb:name="SurfWatch" wmb:UUID="6c0000f7-4501-0000-0080-d6b3e1d5c115"
                wmb:threadId="10044" />
   <wmb:node wmb:nodeLabel="SURFWATCH" wmb:nodeType="ComIbmMQInputNode"
                wmb:detail="SURFWATCH" />
   </wmb:messageFlowData>
 </wmb:eventPointData>
</wmb:event>
```

Example

- Message Flows can be tracked by capturing the flow tracking events

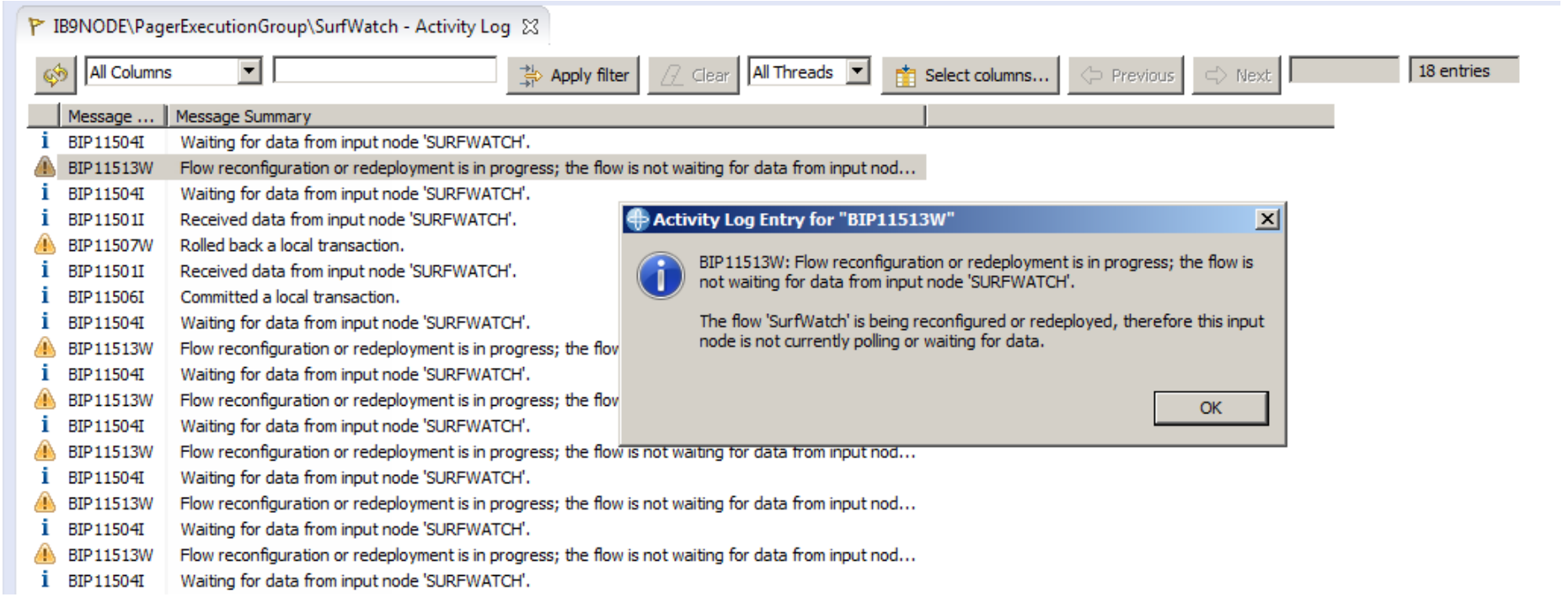




A FEW RELATED ITEMS

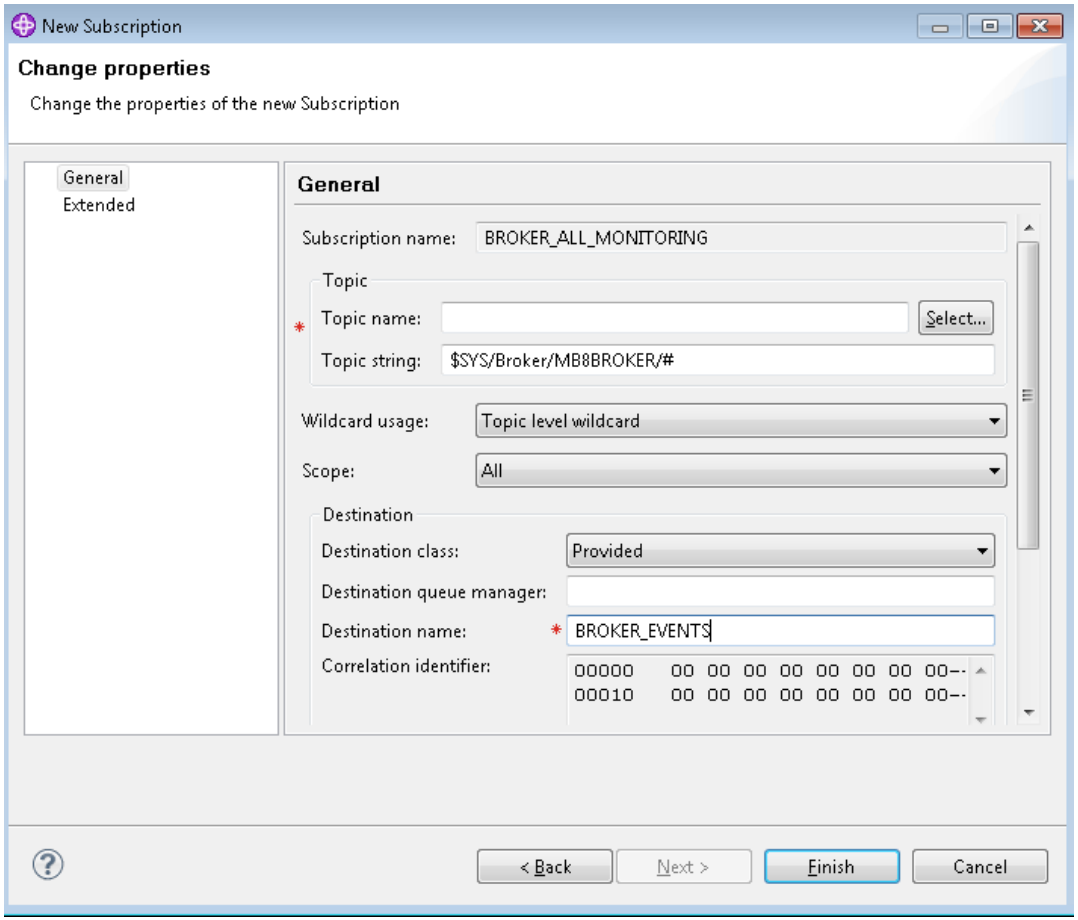
Activity Log

A Useful related capability

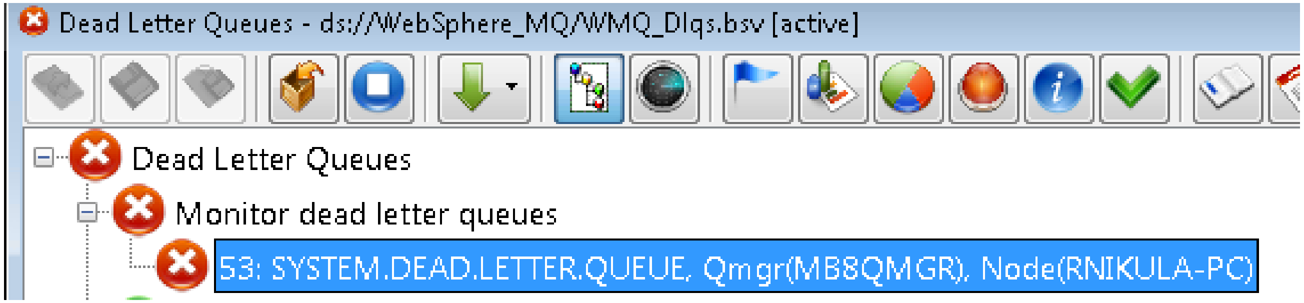


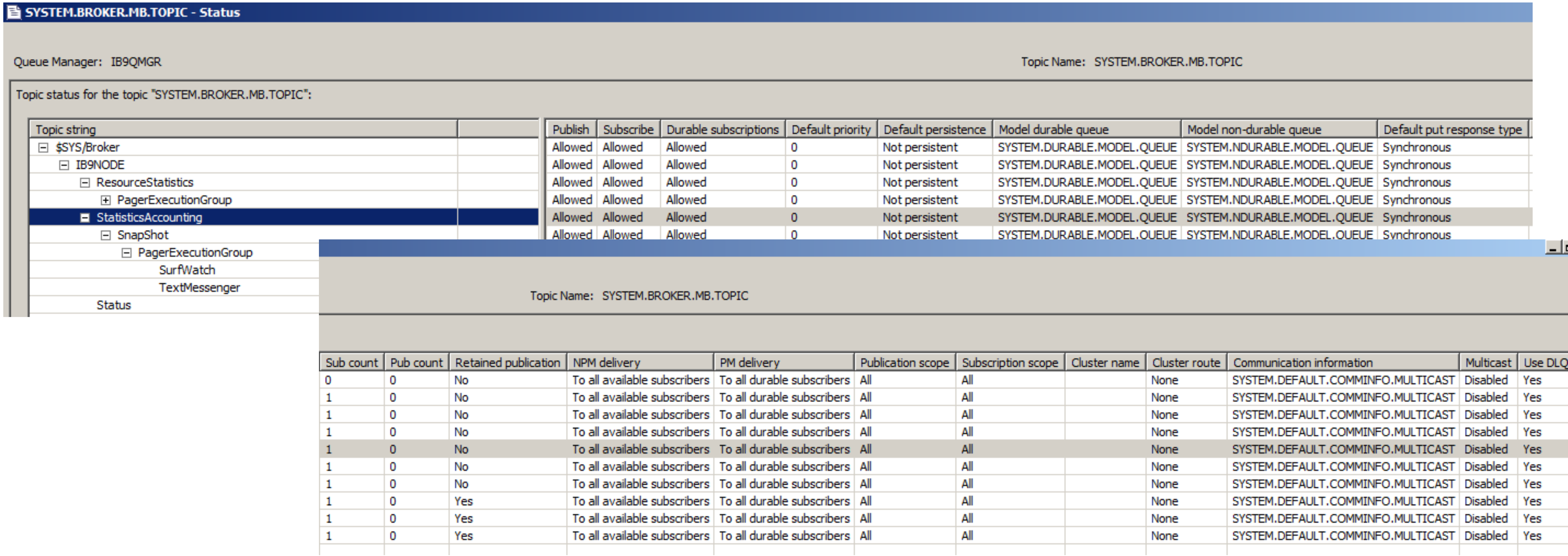
Sample Subscription

- Subscribing for all Broker Data



Bad Things Can Happen





Topic string	Publish	Subscribe	Durable subscriptions	Default priority	Default persistence	Model durable queue	Model non-durable queue	Default put response type
$SYS/Broker	Allowed	Allowed	Allowed	0	Not persistent	SYSTEM.DURABLE.MODEL.QUEUE	SYSTEM.NDURABLE.MODEL.QUEUE	Synchronous
IB9NODE	Allowed	Allowed	Allowed	0	Not persistent	SYSTEM.DURABLE.MODEL.QUEUE	SYSTEM.NDURABLE.MODEL.QUEUE	Synchronous
ResourceStatistics	Allowed	Allowed	Allowed	0	Not persistent	SYSTEM.DURABLE.MODEL.QUEUE	SYSTEM.NDURABLE.MODEL.QUEUE	Synchronous
PagerExecutionGroup	Allowed	Allowed	Allowed	0	Not persistent	SYSTEM.DURABLE.MODEL.QUEUE	SYSTEM.NDURABLE.MODEL.QUEUE	Synchronous
StatisticsAccounting	Allowed	Allowed	Allowed	0	Not persistent	SYSTEM.DURABLE.MODEL.QUEUE	SYSTEM.NDURABLE.MODEL.QUEUE	Synchronous
SnapShot	Allowed	Allowed	Allowed	0	Not persistent	SYSTEM.DURABLE.MODEL.QUEUE	SYSTEM.NDURABLE.MODEL.QUEUE	Synchronous
PagerExecutionGroup								
SurfWatch								
TextMessenger								
Status								

Sub count	Pub count	Retained publication	NPM delivery	PM delivery	Publication scope	Subscription scope	Cluster name	Cluster route	Communication information	Multicast	Use DLQ
0	0	No	To all available subscribers	To all durable subscribers	All	All		None	SYSTEM.DEFAULT.COMMINFO.MULTICAST	Disabled	Yes
1	0	No	To all available subscribers	To all durable subscribers	All	All		None	SYSTEM.DEFAULT.COMMINFO.MULTICAST	Disabled	Yes
1	0	No	To all available subscribers	To all durable subscribers	All	All		None	SYSTEM.DEFAULT.COMMINFO.MULTICAST	Disabled	Yes
1	0	No	To all available subscribers	To all durable subscribers	All	All		None	SYSTEM.DEFAULT.COMMINFO.MULTICAST	Disabled	Yes
1	0	No	To all available subscribers	To all durable subscribers	All	All		None	SYSTEM.DEFAULT.COMMINFO.MULTICAST	Disabled	Yes
1	0	No	To all available subscribers	To all durable subscribers	All	All		None	SYSTEM.DEFAULT.COMMINFO.MULTICAST	Disabled	Yes
1	0	No	To all available subscribers	To all durable subscribers	All	All		None	SYSTEM.DEFAULT.COMMINFO.MULTICAST	Disabled	Yes
1	0	Yes	To all available subscribers	To all durable subscribers	All	All		None	SYSTEM.DEFAULT.COMMINFO.MULTICAST	Disabled	Yes
1	0	Yes	To all available subscribers	To all durable subscribers	All	All		None	SYSTEM.DEFAULT.COMMINFO.MULTICAST	Disabled	Yes
1	0	Yes	To all available subscribers	To all durable subscribers	All	All		None	SYSTEM.DEFAULT.COMMINFO.MULTICAST	Disabled	Yes

SUMMARY

Where to Start

- **Resource Statistics**
  - Identify resource usage
- **Flow Statistics**
  - How Broker is being used
- **Flow Tracking**
  - Advanced analysis
  - Special use cases (audit)

Other sources

- **Session “Performance Considerations for IBM MQ and IBM Integration Bus”**
- **Redbooks/Web Sessions**

Summary

- Message Broker provides a wealth of statistics and performance data
- Collection is an integrated component of the broker
- You can select the level of data collection required
- Tracking data can be used to augment the statistical data

Questions & Answers