

Message Broker Performance

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Agenda

- Introduction
- What are the main costs in message flows?
- What are the best practises to avoid those costs?
- Identifying and making improvements
- Performance Reports
- V7 Improvements
- Summary

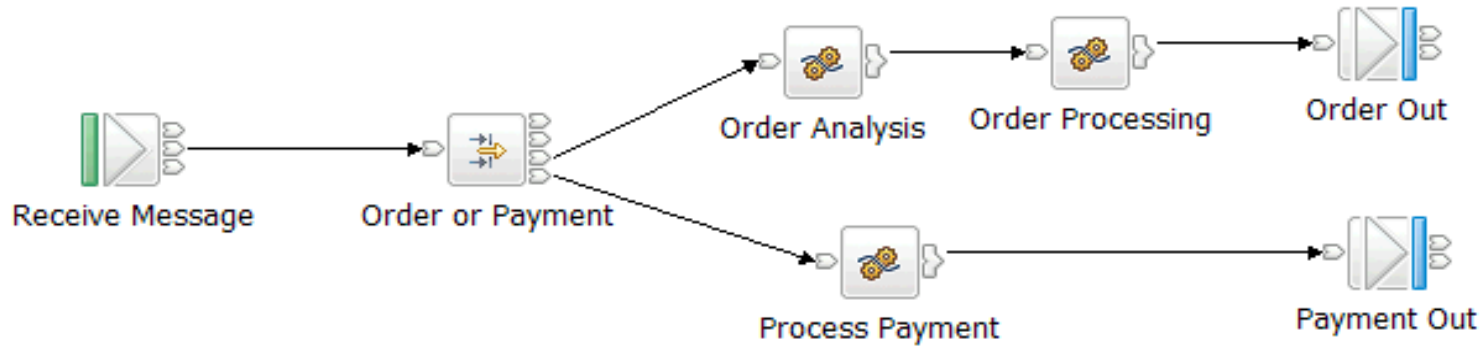
Introduction

- Performance should be thought of from day one!!
 - IP04: WebSphere Message Broker: Designing for Performance
- In reality pressures or poor planning can lead to it becoming an after thought!
- There is a need to know what areas of a WMB implementation should/could be improved.
- Often customers have no idea what the main costs are, how to measure, analyse and improve performance.

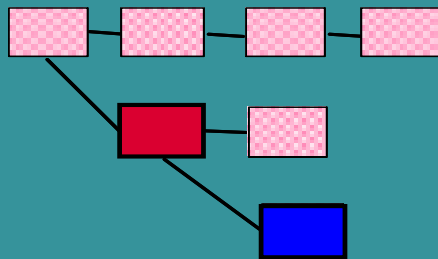
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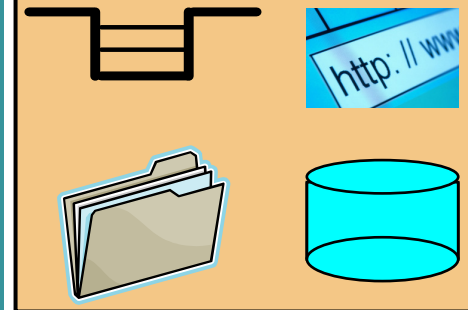
What are the main costs in a message flows?



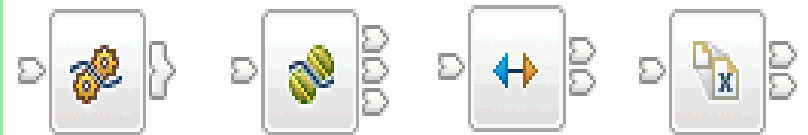
Message Tree



Resources



Message / Business Processing



Message Flow Processing Constituent Costs



- This foils shows a simple message flow. When this or any other message flow processes messages costs arise. These costs are:
 - Parsing. This has two parts. The processing of incoming messages and the creation of output messages. Before an incoming message can be processed by the nodes or ESQL it must transformed from the sequence of bytes, which is the input message, into a structured object, which is the message tree. Some parsing will take place immediately such as the parsing of the MQMD, some will take place, on demand, as fields in the message payload are referred to within the message flow. The amount of data which needs to be parsed is dependent on the organization of the message and the requirements of the message flow. Not all message flows may require access to all data in a message. When an output message is created the message tree needs to be converted into an actual message. This is a function of the parser. The process of creating the output message is referred to as serialization or flattening of the message tree. The creation of the output message is a simpler process than reading an incoming message. The whole message will be written at once when an output message is created. We will discuss the costs of parsing in more detail later in the presentation.
 - Message/Business Processing. It is possible to code message manipulation or business processing in any one of a number of transformation technologies. These are ESQL, Java, PHP, Mapping node, XSL and WebSphere TX mappings. It is through these technologies that the input message is processed and the tree for the output message is produced. The cost of running this is dependent on the amount and complexity of the transformation processing that is coded.

Message Flow Processing Constituent Costs

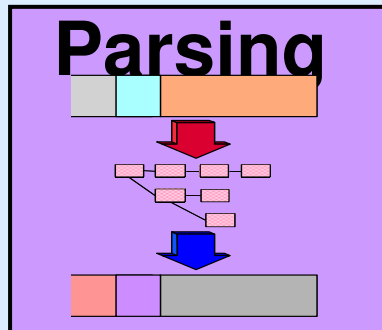


- Navigation. This is the process of "walking" the message tree to access the elements which are referred to in the ESQL or Java. The cost of navigation is dependent on the complexity and size of the message tree which is in turn dependent on the size and complexity of the input messages and the complexity of the processing within the message flow.
- Tree Copying. This occurs in nodes which are able to change the message tree such as Compute nodes. A copy of the message tree is taken for recovery reasons so that if a compute node makes changes and processing in node incurs or generates an exception the message tree can be recovered to a point earlier in the message flow. Without this a failure in the message flow downstream could have implications for a different path in the message flow. The tree copy is a copy of a structured object and so is relatively expensive. It is not a copy of a sequence of bytes. For this reason it is best to minimize the number of such copies, hence the general recommendation to minimize the number of compute nodes in a message flow. Tree copying does not take place in a Filter node for example since ESQL only references the data in the message tree and does not update it.
- Resources. This is the cost of invoking resource requests such as reading or writing WebSphere MQ messages or making database requests. The extent of these costs is dependent on the number and type of the requests.
- The parsing, navigation and tree copying costs are all associated with the population, manipulation and flattening of the message tree and will be discussed together a little later on.
- Knowing how processing costs are encountered puts you in a better position to make design decisions which minimize those costs. This is what we will cover during the course of the presentation.

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Parsing



- The means of populating and serialising the message tree
 - Multiple parsers available: XMLNSC, MRM XML, CWF, TDS, MIME, JMSMap, JMSStream, BLOB, IDOC, RYO
 - Message complexity varies significantly
- ...and so do costs!

- Occurs whenever the message body is accessed
- Ways to reduce/eliminate parsing costs
 - Use cheapest parser possible – XMLNSC for XML parsing!
 - Identify the message type quickly
 - Use Parsing strategies
 - Parsing avoidance
 - Partial parsing
 - Opaque parsing

Design Considerations



- In order to be able to process a message or piece of data within Message Broker we need to be able to model that data and build a representation of it in memory. Once we have that representation we can transform the message to the required shape, format and protocol using transformation processing such as ESQL or Java. That representation of a sequence of bytes into a structured object is the message tree. It is populated through a process called parsing.
- There are two parts to parsing within Message Broker:
 - The first is the most obvious. It is the reading and interpretation of the input message and recognition of tokens within the input stream. Parsing can be applied to message headers and message body. The extent to which it is applied will depend on the situation. As parsing is an expensive process in CPU terms it is not something that we want to automatically apply to every part of every message that is read by a message flow. In some situations it is not necessary to parse all of an incoming message in order to complete the processing within the message flow. A routing message flow may only need to read a header property such as user identifier or ApplIdentifyData in the MQMD for example. If the input message is very large parsing the whole message could result in a large amount of additional CPU being unnecessarily consumed if that data is not required in the logic of the message flow.
 - The second, is the flattening, or serialisation of a message tree to produce a set of bytes which correspond to the wire protocol of a message in the required output format and protocol.

Design Considerations

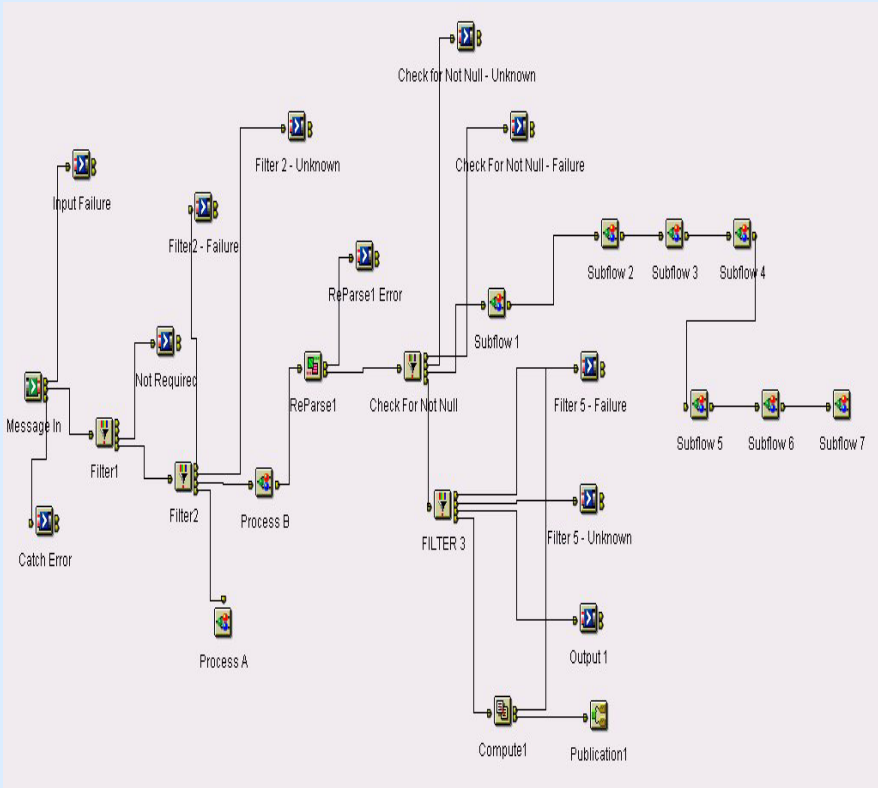


- Message Broker provides a range of parsers. The parsers are named on the foil. The parsers cover different message formats. There is some overlap – XMLNSC and MRM XML are both able to parse a generic XML message but there are also differences. MRM XML can provide validation. XMLNSC does not. Other parsers such as JMSStream are targeted at specific message formats. In this case it is a JMS stream message.
- Messages vary significantly in their format and the level of complexity which they are able to model. Tagged Delimited string (TDS) messages for example can support nested groups. More complex data structures make parsing costs higher. The parsing costs of different wire formats is different. You are recommended to refer to the performance reports in order to get information on the parsing costs for different types of data.
- Whatever the message format there are a number of techniques that can be employed to reduce the cost of parsing. We will now look at the most common ones. First though we will discuss the reasons for the different cost of parsing.

Identifying the Message Type Quickly

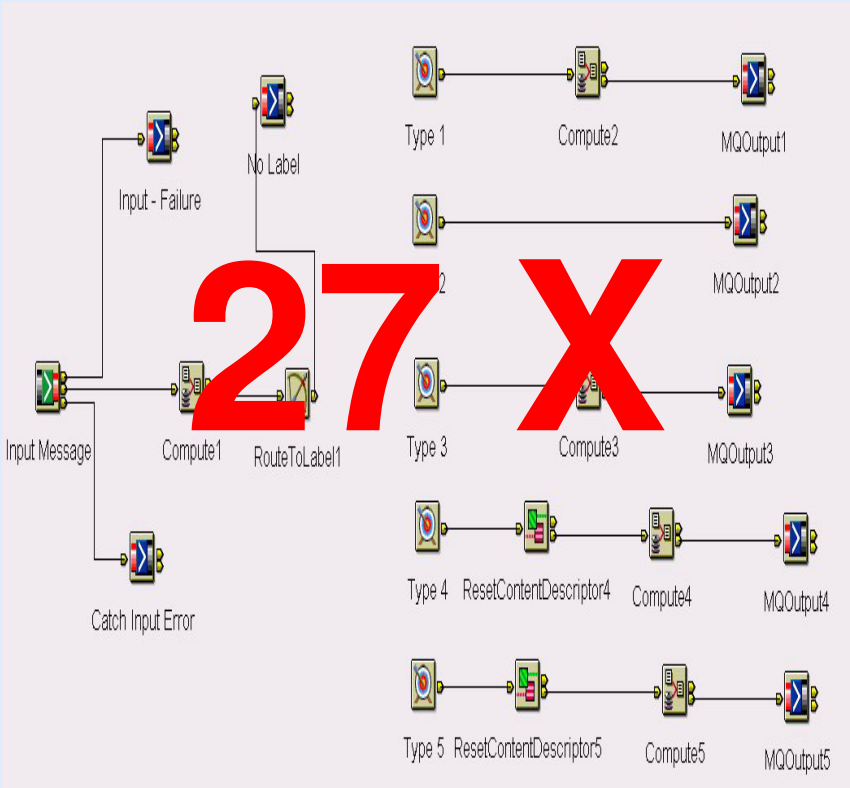


- Avoid multiple parses to find the message type



5 msgs/sec

VS



138 msgs/sec

Identifying the Message Type Quickly



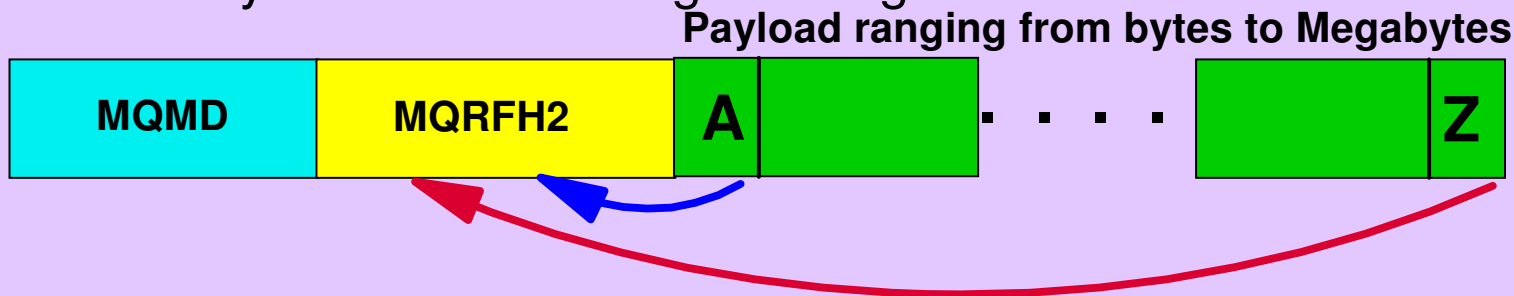
- It is important to be able to correctly recognise the correct message format and type as quickly as possible. In message flows which process multiple types of message this can be a problem. When often happens is that the message needs to be parsed multiple times in order to ensure that you have the correct format. Dependent on the particular format and the amount of parsing needed this can be expensive.
- This example shows how a message flow which processed multiple types of input message was restructured to provide a substantial increase in message throughput.
- Originally the flow was implemented as a flow with a long critical path. Some of the most popular messages were not processed until late in the message flow resulting in a high overhead. The flow was complex. This was largely due to the variable nature of the incoming messages, which did not have a clearly defined format. Messages had to be parsed multiple times.
- The message flow was restructured. This substantially reduced the cost of processing. The two key features of this implementation were to use a very simple message set initially to parse the messages and the use of the RouteToLabel and Label nodes within the message flow in order to establish processing paths which were specialized for particular types of message.
- Because of the high processing cost of the initial flow it was only possible to process 5 non persistent message per second using one copy of the message flow. With the one copy of the restructured flow it was possible to process 138 persistent messages per second on the same system. This is a 27 times increase in message throughput plus persistent messages where now being processed whereas previously they were non persistent.
- By running five copies of the message flow it was possible to:
 - Process around 800 non persistent messages per second when running with non persistent messages.
 - Process around 550 persistent messages per second when running with persistent messages.

Parsing Avoidance



- Removing the need to parse a body of data

- Promote/copy data to MQMD, MQRFH2 or JMS Properties
 - May save having to parse the message body
 - Particularly useful for message routing



- Consider sending only changed data
 - If it isn't there it can't be parsed!
 - More application logic but can reduce volume of data to transport and parse

Parsing Avoidance



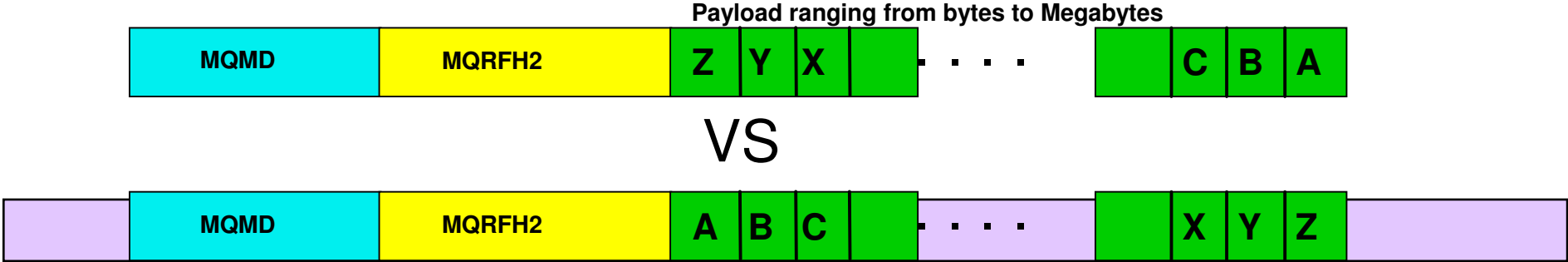
- One very effective technique to reduce the cost of parsing is not to do it. A couple of ways of doing this are discussed in this foil.
- The first approach is to avoid having to parse some parts of the message. Suppose we have a message routing message flow which needs to look at a field in order to make a routing decision. If that field is in the body of the message the body of the incoming message will have to be parsed to get access to it. The processing cost will vary dependent on which field is needed. If it is field A that is OK as it is at the beginning of the body and would be found quickly. If it is field Z then the cost could be quite different, especially if the message is several megabytes in size. A technique to reduce this cost would be to have the application which creates this message copy the field that is needed for routing into a header within the message, say in an MQRFH2 header for an MQ message or as a JMS property if it is a JMS message. If you were to do this it would no longer be necessary to parse the message body so potentially saving a large amount of processing effort. The MQRFH2 header or JMS Properties folder would still need to be parsed but this is going to be smaller amount of data. The parsers in this case are also more efficient than the general parser for a message body as the structure of the header is known.
- A second approach to not parsing data is to not send it in the first place. Where two applications communicate consider sending only the changed data rather than sending the full message. This requires additional complexity in the receiving application but could potentially save significant parsing processing dependent on the situation. This technique also has the benefit of reducing the amount of data to be transmitted across the network.

Partial Parsing



- Parsing only as far as is needed
 - Explicit(ESQL) VS Implicit(XPath)

- Careful ordering of message fields can reduce the cost



Ratio of CPU Costs	1K Message	16K Message	256K Message
Filter First	1	1	1
Filter Last	1.4	3.4	5.6

Measurements taken on pSeries 570 Power 5 with 8 * 1.5 GHZ processors. WebSphere Message Broker V6

Partial Parsing



- Given parsing of the body is needed the next technique is to only parse what is needed rather than parse the whole message just in case. The parsers provided with Message Broker all support partial parsing.
- The amount of parsing which needs to be performed will depend on which fields in a message need to be accessed and the position of those fields in the message. We have two examples here. One with the fields ordered Z to A and the other with them ordered A to Z. Dependent on which field is needed one of the cases will be more efficient than the other. Say we need to access field Z then the first case is best. Where you have influence over message design ensure that information needed for routing for example is placed at the start of the message and not at the end of the message.
- As an illustration of the difference in processing costs consider the table in the foil. The table shows a comparison of processing costs for two versions of a routing message flow when processing several different message sizes.
- For the filter first test the message flow routes the message based on the first field in the message. For the filter last the routing decision is made based on the last field of the message.
- The CPU costs of running with each message size have been normalised so that the filter first test for each message represents a cost of 1. The cost of the filter last case is then given as a ratio to the filter first cost for that same message size.
- For the 1K message we can see that by using the last field in the message to route the CPU cost of the whole message flow was 1.4 times the cost of using the first field in the same message. This represents the additional parsing which needs to be performed to access the last field.
- For the 16K message, the cost of using the last field in the message had grown to 3.4 times that of the first field in the same message. That is we can only run at one third of the message that we can when looking at the first field of the message.

Partial Parsing



- For the 256K message, the cost of using the last field in the message was 5.6 times that of the first field in the same message. That is we can only run at one fifth of the message that we can when looking at the first field of the message.
- You can see how processing costs quickly start to grow and this was a simple test case. With larger messages the effect would be even more pronounced. Where the whole message is used in processing this is not an issue as all of the data will need to be parsed at some point. For simple routing cases though the ordering of fields can make a significant difference.
- When using ESQL, and Mapping nodes the field references are typically explicit. That is we have references such as `InputRoot.Body.A`. Message Broker will only parse as far as the required message field to satisfy that reference. It will stop at the first instance. When using XPath, which is a query language the situation is different. By default an XPath expression will search for all instances of an element in the message which implicitly means a full parse of the message. If you know there is only one element in a message there is the chance to optimise the XPath query to say only retrieve the first instance. See the ESQL and Java coding tips later in the presentation for more information.

Opaque Parsing

- Model the whole of an XML sub tree as a single element in the message tree containing that part of the bit stream
- Reduces message tree size and parsing costs
- Cannot reference the sub tree in message flow processing

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
  xmlns:soapenc="http://schemas.xmlsoap.org/soap/encoding/"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
```

```
<soapenv:Header/>
```

```
<soapenv:Body>
```

```
<p56:requestAssessorAvailability
  xmlns:p56="http://ws3.st.mqsi.ibm.com/Hub/Docliteral1">
  <p56:claimID>77021964</p56:claimID>
  <p56:carDetails>
    <p56:makeOfCar>porsche</p56:makeOfCar>
    <p56:registration>HK03SSS</p56:registration>
  </p56:carDetails>
  <p56:assArray>
    <p56:assessors>...</p56:assessors>
    ... ..
    <p56:assessors>...</p56:assessors>
  </p56:assArray>
</p56:requestAssessorAvailability>
```

```
<p56:driverID>2739694321</p56:driverID>
```

```
</soapenv:Body>
```

```
</soapenv:Envelope>
```

Opaque Parsing

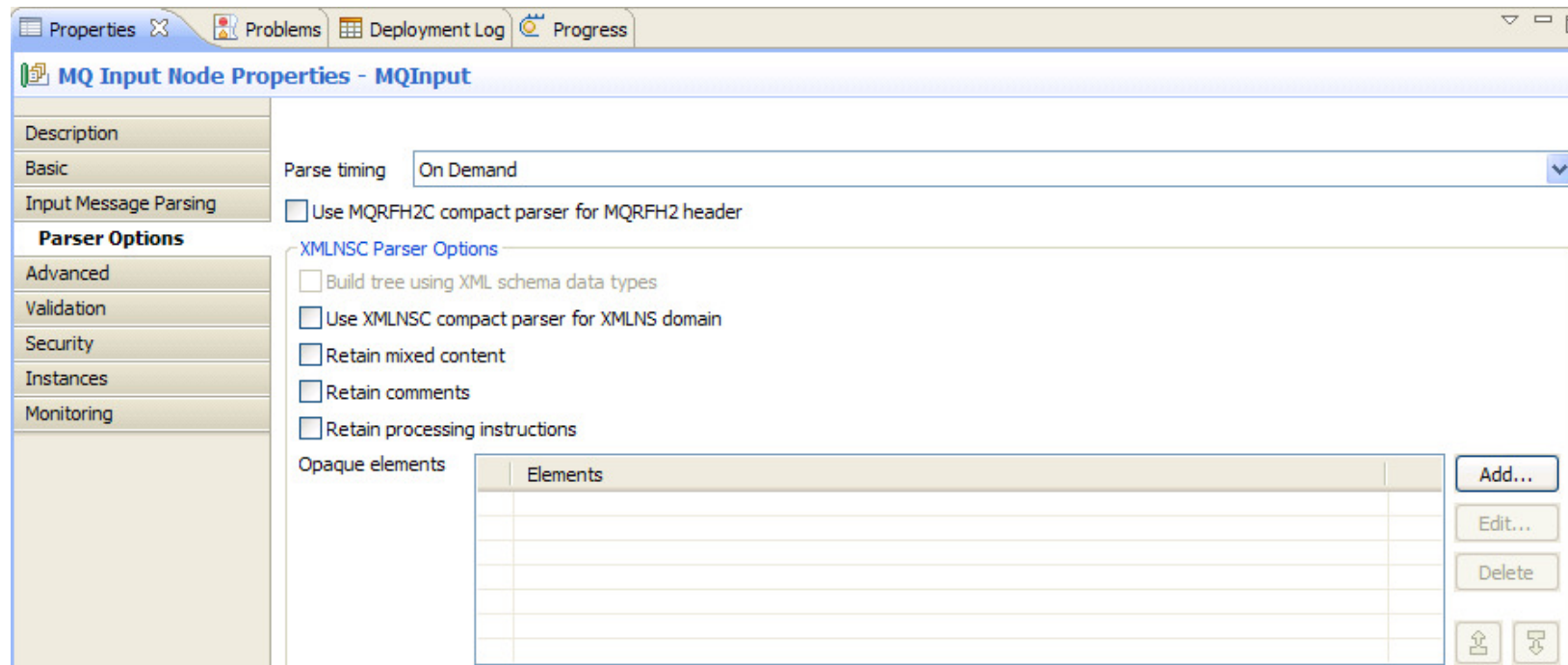


- Opaque parsing is a technique that allows the whole of an XML sub tree to be placed in the message tree as a single element. The entry in the message tree is the bit stream of the original input message. This technique has two benefits:
 - It reduces the size of the message tree since the XML sub tree is not expanded into the individual elements.
 - The cost of parsing is reduced since less of the input message is expanded as individual elements and added to the message tree.
- Use opaque parsing where you do not need to access the elements of the sub tree, for example you need to copy a portion of the input tree to the output message but may not care about the contents in this particular message flow. You accept the content in the sub folder and have no need to validate or process it in any way.
- Opaque parsing is supported for the XMLNS and XMLNSC domains only.
 - The support for the XMLNS domain was introduced in Message Broker V6 fixpack 1 and was an early version of opaque parsing and as such could be changed in the future.
 - The support for the XMLNSC domain was added in Message Broker V6.1. It has a different interface from the XMLNS domain to specify the element names which are to be opaquely parsed.
- The support for the XMLNS domain continues to be available in its original form. Indeed this is the only way in which the messages in the XMLNS domain can be opaquely parsed. It is not possible to use the same interface that is provided for the XMLNSC to specify element names for the XMLNS domain.
- The following pages of notes explain how opaque parsing is performed for messages in the XMLNS and XMLNSC domains.

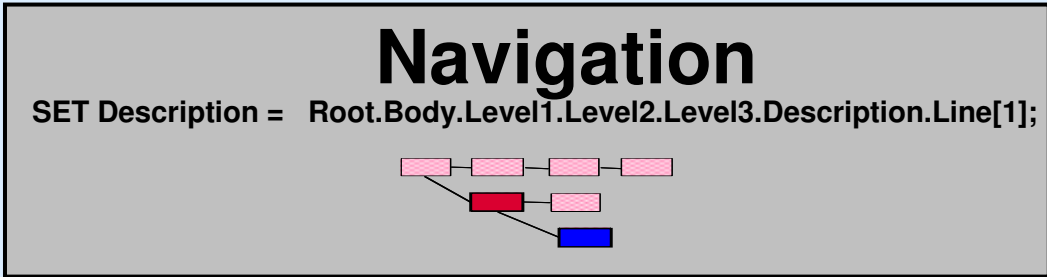
Opaque Parsing for the XMLNSC domain



- The message domain must be set to XMLNSC.
- The elements in the message which are to be opaquely parsed are specified on the 'Parser Options' page of the input node of the message flow. See the picture below of the MQInput node.
- Enter those element names that you wish to opaquely parse in the 'Opaque Elements' table.
- Be sure not to enable message validation as it will automatically disable opaque parsing. Opaque parsing in this case does not make sense since for validation the whole message must be parsed and validated.
- Opaque parsing for the named elements will occur automatically when the message is parsed.
- It is not currently possible to use the CREATE statement to opaquely parse a message in the XMLNSC domain.



Navigation



- **The means of walking the message tree**
 - **Occurs in Compute, JavaCompute and Mapping Nodes**

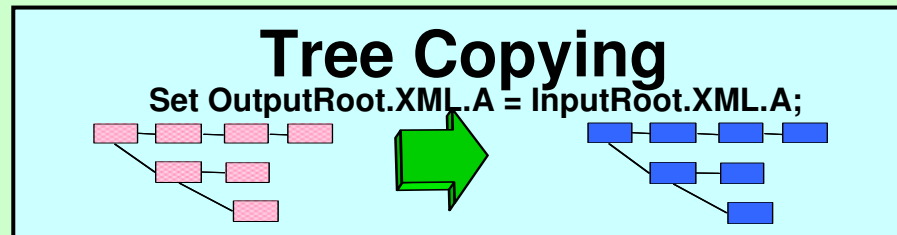
- Ways to reduce navigation costs
 - Build smaller Message Tree
 - Smaller messages,
 - Use Compact Parsers (XMLNSC, MRM XML, RFH2C)
 - Opaque parsing, partial parsing
 - ESQL/Java
 - Use reference variables/pointers

Navigation



- Navigation is the process of accessing elements in the message tree. It happens when you refer to elements in the message tree in the Compute, JavaCompute, PHP and Mapping nodes.
- The cost of accessing elements is not always apparent and is difficult to separate from other processing costs.
- The path to elements is not cached from one statement to another. If you have the ESQL statement
SET Description = Root.Body.Level1.Level2.Level3.Description.Line[1]; the broker runtime will access the message tree starting at the correlation Root and then move down the tree to Level1, then Level2, then Level3, then Description and finally it will find the first instance of the Line array. If you have this same statement in the next line of your ESQL module exactly the same navigation will take place. There is no cache to the last referenced element in the message tree. This is because access to the tree is intended to be dynamic to take account of the fact that it might change structure from one statement to another. There are techniques available though to reduce the cost of navigation.
- With large message trees the cost of navigation can become significant. There are techniques to reduce which you are recommended to follow:
 - Use the compact parsers (XMLNSC, MRM XML and RFH2C). The compact parsers discard comments and white space in the input message. Dependent on the contents of your messages this may have an effect of not. By comparison the other parsers include data in the original message, so white space and comments would be inserted into the message tree.
 - Use reference variables if using ESQL or reference pointers if using Java. This technique allows you to save a pointer to a specific place in the message tree. Say to Root.Body.Level1.Level2.Level3.Description for example.
- For an example of how to use reference variables and reference pointers see the coding tips given in the Common Problems section.

Message Tree Copying



- The process of copying the message tree (whole or part)
 - Occurs in Compute, JavaCompute, Mapping Nodes

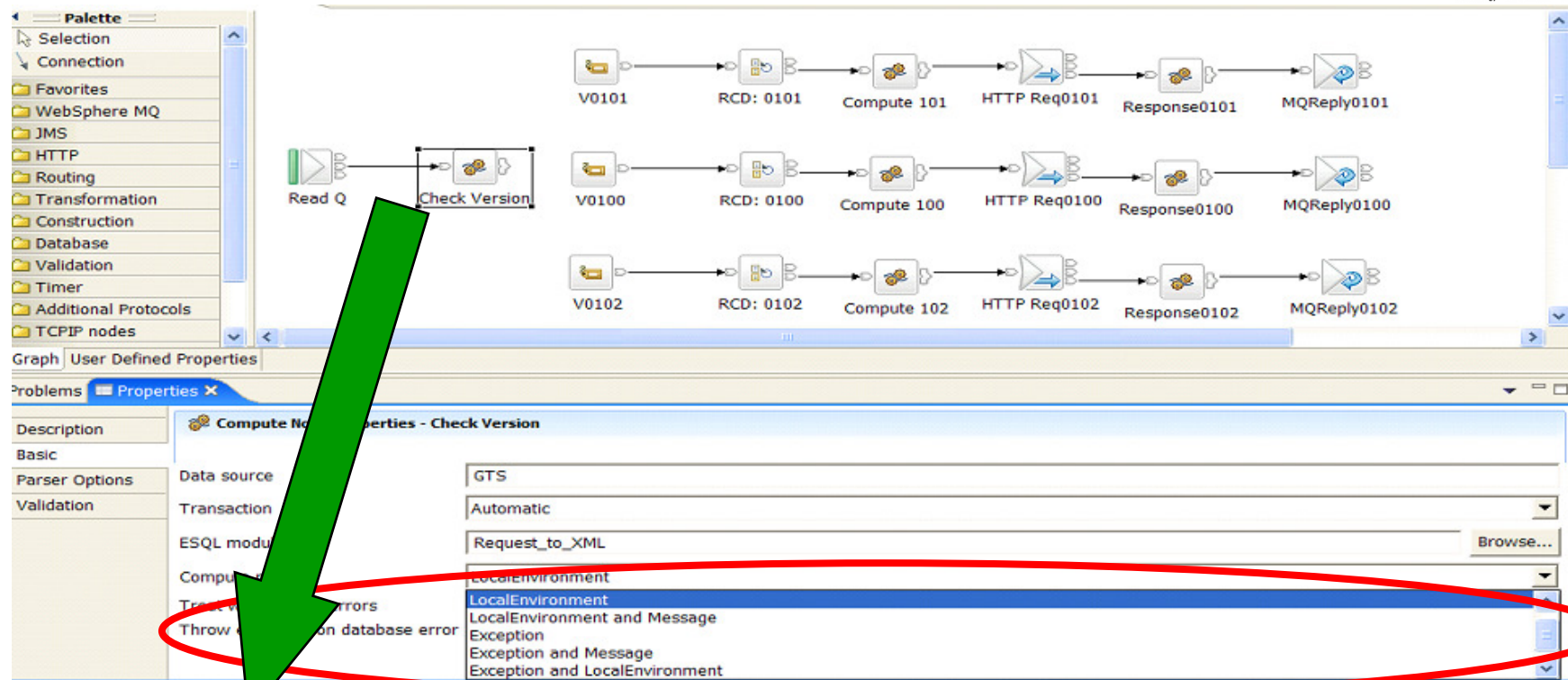
- Ways to reduce tree copying costs
 - Produce a smaller message tree
 - Smaller messages,
 - Use Compact Parsers (XMLNSC)
 - Opaque parsing, partial parsing
 - Reduce the number of times the tree is copied
 - **Reduce the number of Compute and JavaCompute nodes in the flow**
 - *See if Compute mode not using `message` is possible (see notes)*
 - Copy at the highest level in the tree that is possible
 - Copy data to the Environment correlation (remember it is not backed out)

Tree Copying



- Tree Copying is the process of copying the message tree either in whole or part.
- Copying occurs in nodes which are able to change the message tree such as Compute nodes. A copy of the message tree is taken for recovery reasons so that if a compute node makes changes and processing in node incurs or generates an exception the message tree can be recovered to a point earlier in the message flow. Without this a failure in the message flow downstream could have implications for a different path in the message flow. The tree copy is a copy of a structured object and so is relatively expensive. It is not a copy of a sequence of bytes. For this reason it is best to minimize the number of such copies, hence the general recommendation to minimize the number of compute nodes in a message flow. Tree copying does not take place in a Filter node for example since ESQL only references the data in the message tree and does not update it.
- There are a few ways to reduce the costs of tree copying. These are:
 - Produce a smaller message tree in the first place. A smaller tree will cost less to copy. Ways to achieve this are to use Smaller messages, use Compact Parsers (XMLNSC, MRM XML, RFH2C), use Opaque parsing partial parsing (all discussed previously).
 - Reduce the number of times the whole tree is copied. Reducing the number of compute nodes (ESQL or Java) will help to reduce the number of times that the whole tree needs to be copied. In particular avoid situations where you have one compute node followed immediately by another. In many cases you may need multiple computes across a message flow. What we want to do is to optimise the processing not have to force everything into one compute node.
 - Copy portions of the tree at the branch level if possible rather than copying individual leaf nodes. This will only work where the structure of the source and destination are the same but it is worth doing if possible.
 - Copy data to the Environment correlation (remember it is not backed out) and work with it in Environment. This way the message tree does not have to be copied every time you run a compute node. Environment is a scratchpad area which exists for each invocation of a message flow. The contents of Environment are accessible across the whole of the message flow. Environment is cleared down at the end of each message flow invocation.
 - The first compute node in a message flow can copy InputRoot to Environment. Intermediate nodes then read and update values in the Environment instead of using the InputRoot and OutputRoot correlations as previously.
 - In the final compute node of the message flow OutputRoot must be populated with data from Environment. The MQOutput node will then serialize the message as usual. Serialization will not take place from Environment.
 - Whilst use of the Environment correlation is good from a performance point of view be aware that the any updates made by a node which subsequently generates an exception will remain in place. There is no back-out of changes as there is when a message tree copy was made prior to the node exception

Example of Avoiding a Tree Copy



The screenshot shows a flow diagram with three parallel paths. Each path starts with a 'Read Q' node, followed by a 'Check Version' node, then a 'Compute' node (labeled V0101, V0100, V0102), an 'HTTP Req' node, a 'Response' node, and finally an 'MQReply' node. A green arrow points from the 'Check Version' node in the first path to the 'Properties - Check Version' window. In this window, the 'LocalEnvironment' dropdown is highlighted with a red circle.

```
-- Set the version numbers this flow supports
SET Environment.SupportedVersions = '0102 0101 0100';

-- getMessageVersion returns label name for the message version (for example, '0102')
PROPAGATE TO LABEL 'V' || getMessageVersion(Environment, InputRoot, TRUE);

-- PROPAGATE already passed the message; do not propagate to "Out"
RETURN FALSE;
```

Example of Avoiding a Tree Copying



- This foil shows one case where it was possible to avoid a tree copy. You may be able to use this same technique in other situations.
- The purpose of the message flow is read MQ messages, determine the message type and route to the appropriate type of processing. There are three legs of processing, each starting with a Label node (V0100, V0101 & V0102).
- The compute node Check_Version issues a PROPAGATE to the appropriate label node dependent on a field in the incoming message. The message version information is obtained from the incoming message by a function called getMessageVersion. The ESQL on the foil shows how this is done.
- As processing at this point is limited to routing only there is no need for Check_Version to modify the incoming message tree and as such a value of LocalEnvironment is sufficient for the Compute Mode of the node. Had a value of LocalEnvironment and Message been selected then we would have needed to copy the message tree which would have increased processing costs, unnecessarily in this case.

Business Processing



- The choices...
 - ESQL
 - Java
 - Mapping Node
 - eXtensible Stylesheet Language(XSL)
 - WebSphere TX

- Minimise mixture of technologies
 - ESQL, Java, Mapping node
 - WTX and XSLT

- Factors in choosing a transformation option:
 - Existing skills
 - Availability of new skills
 - Re-use of existing assets
 - Throughput requirements

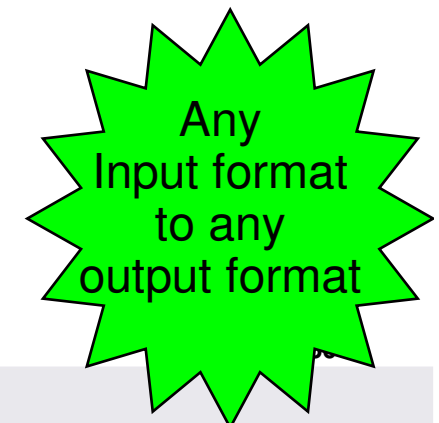
Business Processing



- There are a number of different transformation technologies available with Message Broker V7. These are:
 - ESQL, an SQL like syntax, which runs in nodes such as the Compute, Filter and Database.
 - Java which runs in a JavaCompute node.
 - The Mapping node. The mapping capability was rewritten in V6. It gives a spreadsheet style format in which you can specify the connection of source and destination fields along with some additional processing.
 - Extensible Stylesheets (XSL) running in an XML Transformation node. This provides a good opportunity to reuse an existing asset.
 - PHP which runs in the PHPCompute node.
 - The WTX node which runs a WTX map to parse the message.
- As there is a choice of transformation technology this offers significant flexibility. All of these technologies can be used within the same message flow if needed.
- Different technologies will suit different projects and different requirements.
- Factors which you may want to take into account when making a decision about the use of transformation technology are:
 - The pool of development skills which is available. If developers are already skilled in the use of ESQL you wish continue using this as the transformation technology of choice. If you have a strong Java skills then the JavaCompute node may be more relevant, rather than having to teach your Java programmers ESQL.
 - The ease with which you could teach developers a new development language. If you have many developers it may be not be viable to teach all of the ESQL for example and you may only educate a few and have them develop common functions or procedures.
 - The skill of the person. Is the person an established developer, or is the mapping node more suitable.
 - Asset re use. If you are an existing user of Message Broker you may have large amounts of ESQL already coded which you wish to re-use. You may also have any number of resources that you wish to re-use such as Java classes for key business processing, stylesheets, PHP scripts or WTX mappings. You want to use these as the core of message flow processing and extend the processing with one of the other technologies.
 - Performance. If message throughput is a prime consideration then you will most likely want to consider using ESQL or Java.
- Think carefully before combining a lot of different transformation technologies within a path of execution of a message flow. ESQL, Java, PHP and Mapping node will happily intermix but there is an overhead in moving to/from other technologies such as XSL as they do not access the message directly. The message has to be serialised when it is passed to those other technologies and then the results parsed to build a new message tree.

Transport Costs

- Different protocols have different performance characteristics
- **MQ**
 - Tune the QM and associated QM's:
 - Use a trusted broker, tune logs, tune buffersizes
 - http://www.ibm.com/developerworks/websphere/library/techarticles/0712_dunn/0712_dunn.html
 - Avoid unnecessary use of persistent messages
 - Always use persistent messages in a transaction
 - Use fast storage if using persistent messages
- **JMS**
 - Follow MQ tuning if using MQ JMS
 - Follow provider instructions
 - http://www.ibm.com/developerworks/websphere/library/techarticles/0604_bicheno/0604_bicheno.html
- **SOAP/HTTP**
 - Use persistent HTTP connections
 - http://www.ibm.com/developerworks/websphere/library/techarticles/0608_braithwaite/0608_braithwaite.html
- **File**
 - Use cheapest delimiting option (see reports)
 - Use fast storage



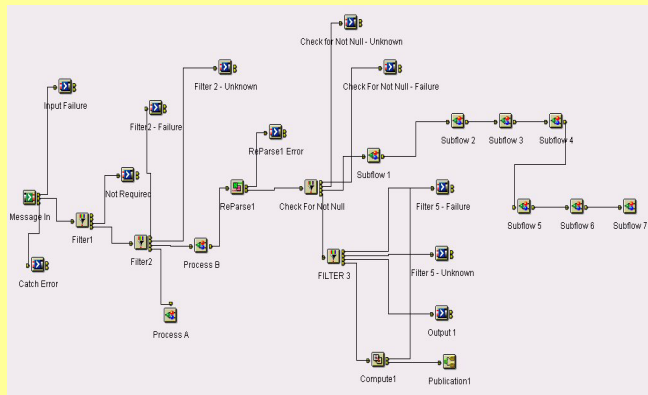
Transport Costs



- There are a wide variety of ways of reading data into Message Broker and sending it out once it has been processed. The most common methods are MQ messages, JMS messages, HTTP and files. Collectively for this discussion lets refer to them as methods of transport although we recognise that is pushing it where file, VSAM and database are concerned.
- Different transports have different reliability characteristics. An MQ persistent message has assured delivery. It will be delivered once and once only. MQ non persistent messages are also pretty reliable but are not assured. If there is a failure of machine or power outage for example data will be lost with these non persistent messages. Similarly data received over a raw TCP/IP session will be unreliable. With WebSphere MQ Real-time messages can be lost if there is a buffer overrun on the client or server for example.
- In some situations we are happy to accept the limitations of the transport in return for its wide availability or low cost for example. In others we may need to make good the shortcoming of the transport. One example of this is the use of a WebSphere MQ persistent message (or database insert) to reliably capture coming over a TCP/IP connection as the TCP/IP session is unreliable – hey this is why MQ is popular because of the value it builds on an unreliable protocol.
- As soon as data is captured in this way the speed of processing is changed. We now start to work at the speed of MQ persistent messages or the rate at which data can be inserted into a database. This can result in a significant drop in processing dependent on how well the queue manager or database are tuned.
- In some cases it is possible to reduce the impact of reliably capturing data if you are prepared to accept some additional risk. If it is acceptable to have a small window of potential loss you can save the data to an MQ persistent message or database asynchronously. This will reduce the impact of such processing on the critical path. This is a decision only you can make. It may well vary by case by case dependent on the value of the data being processed.
- It is important to think how data will be received into Message Broker. Will data be received one message at a time or will it arrive in a batch. What will be involved in session connection set-up and tear-down costs for each message or record that is received by the message flow. Thinking of it in MQ terms will there be an MQCONN, MQOPEN, MQPUT, MQCMT and MQDISC by the application for each message sent to the message flow. Lets hope not as this will generate lot of additional processing for the broker queue manager [assuming the application is local to the broker queue manager]. In the HTTP world you want to ensure that persistent sessions (not to be confused with MQ persistence) are used for example so that session set-up and tear-down costs are minimised. Make sure that you understand the sessions management behaviour of the transport that is being used and that you know how to tune the transport for maximum efficiency.
- Message Broker give you the ability to easily switch transport protocols, so data could come in over MQ and leave the message flow in a file or be sent as a JMS message to any JMS 1.1 provider. In your processing you should aim to keep a separation between the transport used and the data being sent over that transport. This will make it easier to use different transports in the future.

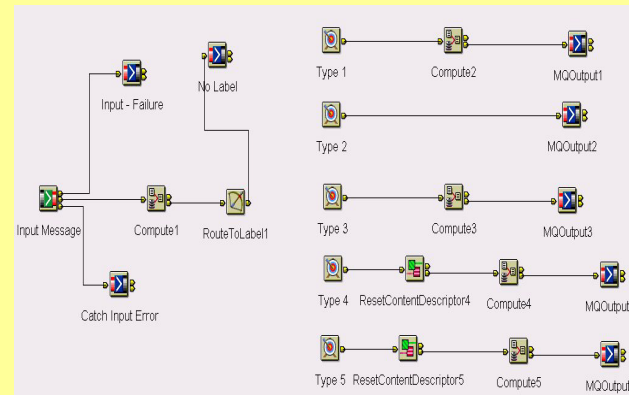
Message Flow Structure

- Specific VS Generic



- Clarity

- RouteToLabel and Label Nodes



- Reuse

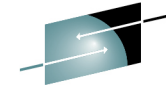
- Subflows

- ESQL Procedures/Functions

- Java Classes

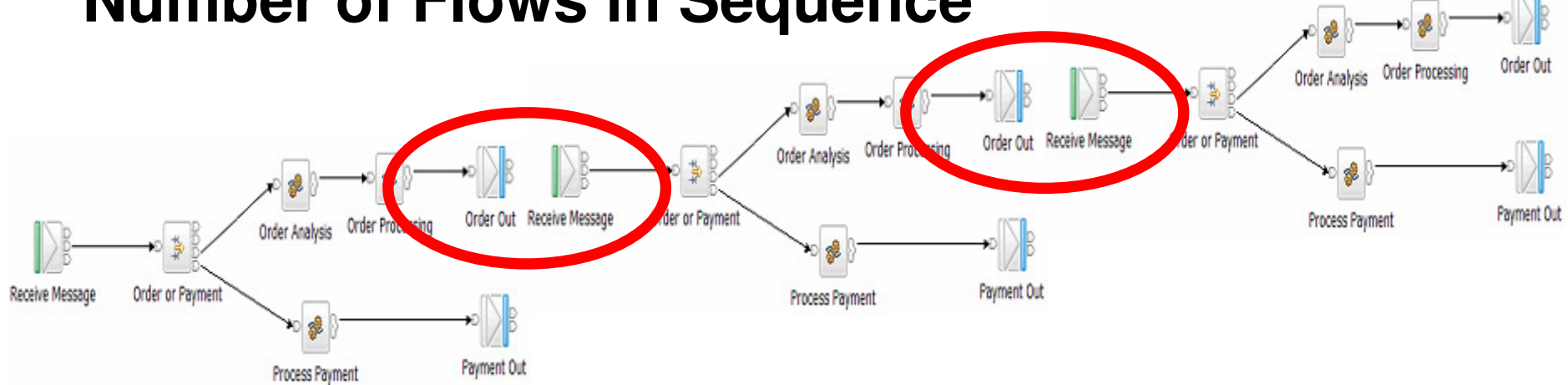
- Stored Procedure

- One VS multiple flows



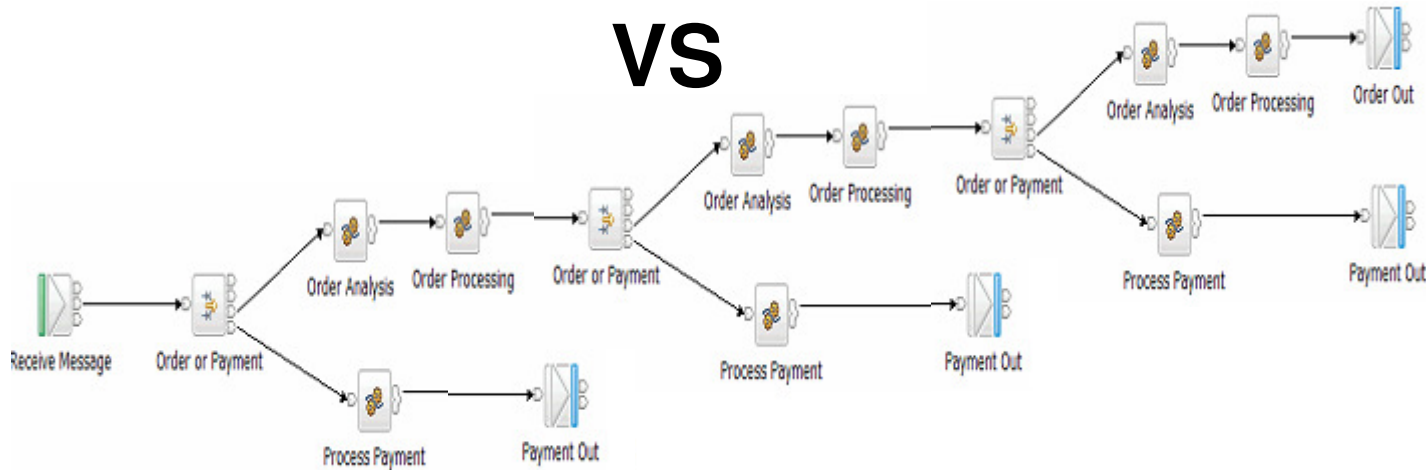
SHARE

Number of Flows in Sequence



3X (Read Msg - Parse – Process - Serialise – Write Msg)

VS



Read Msg - Parse – 3X(Process) - Serialise – Write Msg

Message Flow Structure



- It is important to think about the structure of your message flows and to think about how they will process incoming data. Will one message flow process multiple message types or will it process a single type only. Where a unique message flow is produced for each different type of message it is referred to as a specific flow. An alternative approach is to create message flows which are capable of processing multiple message types. There may be several such flows, each processing a different group of messages. We call this a generic flow.
- There are advantages and disadvantages for both specific and generic flows.
 - With specific flows there are likely to be many different message flows. In fact as many message flows as there are types of input message. This does increase the management overhead which is a disadvantage. A benefit of this approach though is that processing can be optimized for the message type. The message flow does not have to spend time trying to determine the type of message before then processing it.
 - With the generic flow there is a processing cost over and above the specific processing required for that type of message. This is the processing required to determine which of the possible message types a particular message is. Generic flows can typically end up parsing an input message multiple times. Initially to determine the type and then subsequently to perform the specific processing for that type of message. A benefit of the generic flow is that there are likely to be fewer of them as each is able to process multiple message types. This makes management easier. Generic flows tend to be more complex in nature. It is relatively easy to add processing for another type of message though. With generic message flows it is important to ensure that the most common message types are processed first. If the distribution of message types being processed changes over time this could mean processing progressively becomes less efficient. You need to take account of this possibility in your message flow design. Use of the RouteToLabel node can help with this problem.
- There are advantages to both the specific and generic approaches. From a message throughput point of view it is better to implement specific flows. From a management and operation point of view it is better to use generic flows. Which approach you choose will depend on what is important in your own situation.
- To bring clarity to your message flow processing consider using the RouteToLabel node. It can help add structure and be effective in separating different processing paths with a message flow. Without flows can become long and unwieldy resulting in high processing costs for those messages which have a long processing path. See the two examples on the foil. Both perform the same processing but have different structures. One is clearly more readable than the other.
- There are several ways of achieving code reuse with Message Broker. They are subflows, ESQL procedures and functions, invoking external Java classes and calling a database stored procedure. There are some performance implications of using the different techniques which we will briefly look at.

Message Flow Structure



- Subflow's are a facility to encourage the reuse of code. Subflow's can be embedded into message flows. The subflow's are 'in-lined' into the message flow at deploy time. There are no additional nodes inserted into the message flow as a result of using subflow's. However be aware of implicitly adding extra nodes into a message flow as a result of using subflow's. In some situations compute nodes are added to subflow's to perform marshalling of data from one part of the message tree into a known place in the message tree so that the data can be processed by the message flow. The result may then be copied to another part of the message tree before the subflow completes. This approach can easily lead to the addition of two compute nodes, each of which performs a tree copy. In such cases the subflow facilitates the reuse of logic but unwittingly adds an additional processing head. Consider the use of ESQL procedures instead for code reuse. They provide a good reuse facility and the potential additional overhead of extra Compute nodes is avoided.
- Existing Java classes can be invoked from within a message flow using either ESQL or Java.
 - From ESQL it is possible to declare an external function or procedure which specifies the name of the Java routine to be invoked.. Parameters (in,out, in-out) can be passed to the Java routine.
 - From within a Java compute node the class can be invoked as any other Java class. You will need to ensure that the Java class file is accessible to the broker runtime for this to work.
- A database stored procedure can be called from within ESQL by using an external procedure. It is also possible to invoke a stored procedure using a PASSTHRU statement but this is not recommended from a performance point of view.
- The cost of calling these external routines will vary and be dependent on what is being called (Java VS Stored procedure) and the number and type of parameters. The performance reports give the CPU cost of calling different procedure types and you can compare the cost of using these methods to other processing which you might do.
- There are no hard and fast rules about whether to call an external procedure or not. It will very much depend on what code you want to access. It is important to bear in mind the cost of making the call against the function that is being executed. Is it really worth it if the external procedure is only a few lines of code. It might easier to re-write the code and make it available locally within the message flow.
- Database stored procedures can be a useful technique for reducing the size of the result set that is returned to a message flow from a database query. Especially where the result set from an SQL statement might contain hundreds or thousands of rows otherwise. The stored procedure can perform an additional refinement of the results. The stored procedure is close to the data and using it to refine results is a more efficient way of reducing the volume of data. Otherwise data has to be returned to the message flow only to be potentially discarded immediately.

Agenda

- Introduction
- What are the main costs in message flows?
- What are the best practises to avoid those costs?
- **Identifying and making improvements**
- Performance Reports
- V7 Improvements
- Summary

Review your Environment



- **Broker**
 - Trusted application
 - Use of instances and execution groups
 - Non MQ Transport (HTTP, JMS)
- **Broker queue manager**
 - Logging
 - Trusted channels and listeners
 - Performance of connected queue managers
- **Application Databases**
 - Review activity and tune
- **Topology**
 - Distance between broker and data

Tuning the runtime environment



- So far we have focused on the message and contents of the message flow. It is important to have an efficient message flow but this is not the whole story. It is also important to have an efficient environment for the message flow to run in.
- We collectively refer to this as the broker environment. It includes:
 - Configuration of the broker
 - Configuration of the broker queue manager
 - The topology of the environment in which the messages are processed
 - Business database configuration
 - Hardware
 - Software
- It is important that each of these components is well configured and tuned. When this occurs we can get the best possible message throughput for the resources which have been allocated.
- We will now briefly look at each of these aspects. The aim is to outline those aspects which you should be aware of and further investigate rather than to provide full guidance in this presentation.

Tuning the runtime environment



- As with other MQ applications it is possible to run a broker as a trusted application on Windows, Solaris, HP-UX and AIX. The benefit of running in trusted mode is that the cost of an application communicating with the queue manager is reduced and MQ operations are processed more efficiently. It is thus possible to achieve a higher level of messaging with a trusted application. However when running in trusted mode it is possible for a poorly written application to crash and potentially corrupt the queue manager. The likelihood of this happening will depend on user code, such as a plugin node, running in the message flow and the extent to which it has been fully tested. Some users are happy to accept the risk in return for the performance benefits. Others are not.
- Using the MBExplorer it is possible to increase the number of instances of a message flow which are running. Similarly you can increase the number of execution groups and assign message flows to those execution groups. This gives the potential to increase message throughput as there are more copies of the message flow. There is no hard and fast rule as to how many copies of a message flow to run. For guidelines look at the details in the Additional Information section
- Tuning is available for non MQ transports. For example:
 - When using HTTP you can tune the number of threads in the HTTP listener for example. For more detail on how to tune the HTTP support within Message Broker see the article HTTP transport nodes in WebSphere Message Broker V6 at http://www.ibm.com/developerworks/websphere/library/techarticles/0608_braithwaite/0608_braithwaite.html
 - When using JMS nodes follow the tuning advice for the JMS provider that you are connecting to.
- As the broker is dependent on the broker queue manager to get and put MQ messages the performance of this component is an important component of overall performance.
- When using persistent messages it is important to ensure the queue manager log is efficient. Review log buffer settings and the speed of the device on which the queue manager log is located.
- It is possible to run the WebSphere queue manager channels and listener as trusted applications. This can help reduce CPU consumption and so allow greater throughput.
- In practice the broker queue manager is likely to be connected to other queue managers. It is important to examine the configuration of these other queue managers as well in order to ensure that they are well tuned.

Tuning the runtime environment



- The input messages for a message flow do not magically appear on the input queue and disappear once they have been written to the output queue by the message flow. The messages must somehow be transported to the broker input queue and moved away from the output queue to a consuming application.
- Let us look at the processing involved to process a message in a message flow passing between two applications with different queue manager configurations.
 - Where the communicating applications are local to the broker, that is they use the same queue manager as the broker, processing is optimized. Messages do not have to move over a queue manager to queue manager channel. When messages are non-persistent no commit processing is required. When messages are persistent 3 commits are required in order to pass one message between the two applications. This involves a single queue manager.
 - When the communicating applications are remote from the broker queue manager, messages passed between the applications must now travel over two queue manager to queue manager channels (one on the outward, another on the return). When messages are non-persistent no commit processing is required. When messages are persistent 7 commits are required in order to pass one message between the two applications. This involves two queue managers.
- If the number of queue managers between the applications and broker were to increase so would the number of commits required to process a message. Processing would also become dependent on a greater number of queue managers.
- Where possible keep the applications and broker as close as possible in order to reduce the overall overhead.
- Where multiple queue managers are involved in the processing of messages it is important to make sure that all are optimally configured and tuned.

Tuning the runtime environment



- The extent to which business data is used will be entirely dependent on the business requirements of the message flow. With simple routing flows it is unlikely that there will be any database access. With complex transformations there might be involved database processing. This could involve a mixture of read, update, insert and delete activity.
- It is important to ensure that the database manager is well tuned. Knowing the type of activity which is being issued against a database can help when tuning the database manager as you can focus tuning on the particular type of activity which is used.
- Where there is update, insert or delete activity the performance of the database log will be a factor in overall performance. Where there is a large amount of read activity it is important to review buffer allocations and the use of table indices for example.
- It might be appropriate to review the design of the database tables which are accessed from within a message flow. It may be possible to combine tables and so reduce the number of reads which are made for example. All the normal database design rules should be considered.
- Where a message flow only reads data from a table, consider using a read only view of that table. This reduces the amount of locking within the database manager and reduces the processing cost of the read.

Broker Environment - Hardware & Software



- Understand message processing requirements
 - Run the message flows with realistic data - variety of types and sizes
 - Use early testing to plan/validate production environment
- I/O or CPU bound
 - Depends on msg type, size and complexity of flows
 - Use vmstat, Task Manager, SDSF etc to determine which
- Number and speed of processors
- Software
 - Ensure it is tuned
 - Use latest levels

Broker Environment - Hardware & Software



- Allocating the correct resources to the broker is a very important implementation step.
- Starve a CPU bound message flow of CPU and you simply will not get the throughput. Similarly neglect I/O configuration and processing could be significantly delayed by logging activities for example.
- It is important to understand the needs of the message flows which you have created. Determine whether they are CPU bound or I/O bound.
- Knowing whether a message flow is CPU bound or I/O bound is key to knowing how to increase message throughput. It is no good adding processors to a system which is I/O bound. It is not going to increase message throughput. Using disks which are much faster such as a solid state disk or SAN with a fast-write non-volatile cache will have a beneficial effect though.
- As we saw at the beginning Message Broker has the potential to use multiple processors by running multiple message flows as well as multiple copies of those message flows. By understanding the characteristics of the message flow it is possible to make the best of that potential.
- In many message flows parsing and manipulation of messages is common. This is CPU intensive activity. As such message throughput is sensitive to processor speed. Brokers will benefit from the use of faster processors. As a general rule it would be better to allocate fewer faster processors than many slower processors.
- We have talked about ensuring that the broker and its associated components are well tuned and it is important to emphasize this. The default settings are not optimized for any particular configuration. They are designed to allow the product to function not to perform to its peak.
- It is important to ensure that software levels are as current as possible. The latest levels of software such as Message Broker and WebSphere MQ offer the best levels of performance.

Review your Message Flows



- Look to apply the best practises!
- Check the structure:
 - Length and number of nodes
 - Subflow usage and adjacent compute nodes
- Check for coding issues (see notes)
- Look for parsing savings
- Look to reduce tree copies
- Look unnecessary I/O:
 - Look for trace or trace nodes
 - Look for nodes writing to files e.g. JCN
 - Look for unnecessary persistent writes to queues or DB's.

Tips for Coding Efficiently in ESQL - 1

- Avoid use of array subscripts [] on the right hand side of expressions – use reference variables instead. See below. Note also the use of LASTMOVE function to control loop execution.

```
DECLARE myref REFERENCE TO OutputRoot.XML.Invoice.Purchases.Item[1];
-- Continue processing for each item in the array
WHILE LASTMOVE(myref)=TRUE DO
-- Add 1 to each item in the array
SET myref = myref + 1;
-- Move the dynamic reference to the next item in the array
MOVE myref NEXTSIBLING;
END WHILE;
```

- Use reference variables rather than long correlation names such as InputRoot.MRM.A.B.C.D.E. Find a part of the correlation name that is used frequently so that you get maximum reuse in the ESQL. You may end up using multiple different reference variables throughout the ESQL. You do not want to reference variable pointing to InputRoot for example. It needs to be deeper than that.

```
DECLARE myref REFERENCE TO InputRoot.MRM.A.B.C;
SET VALUE = myRef.D.E;
```

- Avoid use of EVAL, it is very expensive!
- Avoid use of CARDINALITY in a loop e.g. `while (I < CARDINALITY (InputRoot.MRM.A.B.C[]))`. This can be a problem with large arrays where the cost of evaluating CARDINALITY is expensive and as the array is large we also iterate around the loop more often. See use of reference variables and LASTMOVE above.
- Combine ESQL into the minimum number of compute nodes possible. Fewer compute nodes means less tree copying.
- Use new FORMAT clause (in CAST function) where possible to perform data and time formatting.
- Limit use of shared variables to a small number of entries (tens of entries) when using an array of ROW variables or order in probability of usage (current implementation is not indexed so performance can degrade with higher numbers of entries).
- For efficient code re-use consider using ESQL modules and schema rather than subflows. What often happens with subflows is that people add extra compute nodes to perform initialisation and finalisation for the processing that is done in the subflow. The extra compute nodes result in extra message tree copying which is relatively expensive as it is a copy of a structured object.

Tips for Coding Efficiently in ESQL - 2



- Avoid use of PASSTHRU with a CALL statement to invoke a stored procedure. Use the "CREATE PROCEDURE ... EXTERNAL ..." and "CALL ..." commands instead
- If you do have to use PASSTHRU use host variables (parameter markers) when using the statement. This allows the dynamic SQL statement to be reused within DB2 [assuming statement caching is active]
- Declare and Initialize ESQL variables in same statement
 - Example:

```
Declare InMessageFmt CHAR;  
Set InMessageFmt = 'SWIFT';  
DECLARE C INTEGER;  
Set C = CARDINALITY(InputRoot.*[]);
```
 - Better to use:

```
Declare InMessageFmt CHAR 'SWIFT';  
DECLARE C INTEGER CARDINALITY(InputRoot.*[])
```
- Initialize MRM output message fields using MRM null/default rather than ESQL
 - Messageset.mset > CWF>Policy for missing elements
 - Use null value
 - Cobol import
 - Create null values for all fields if initial values not set in Cobol
 - Avoids statements like
 - Set OutputRoot.MRM.THUVTILL.IDTRANSIN.NRTRANS = "";
- For frequently used complex structures consider pre-building and storing in a ROW variable which is also a SHARED variable (and so accessible by multiple copies of the message flow). The pre-built structure can be copied across during the processing of each message so saving processing time in creating the structure from scratch each time. For an example of ROW and SHARED variable use see the message flow `Routing_using_memory_cache` which is part of the Message Routing sample in the WebSphere Message Broker Toolkit samples gallery.

Tips for Coding Efficiently in Java



- Follow applicable points from ESQL like reducing the number of compute nodes
- Store intermediate references when building / navigating trees

Instead of

```
MbMessage newEnv = new MbMessage(env);
newEnv.getRootElement().createElementAsFirstChild(MbElement.TYPE_NAME, "Destination", null);
newEnv.getRootElement().getFirstChild().createElementAsFirstChild(MbElement.TYPE_NAME, "MQDestinationList", null);
newEnv.getRootElement().getFirstChild().getFirstChild()
createElementAsFirstChild(MbElement.TYPE_NAME, "DestinationData", null);
```

Store references as follows:

```
MbMessage newEnv = new MbMessage(env);
MbElement destination = newEnv.getRootElement().createElementAsFirstChild(MbElement.TYPE_NAME, "Destination", null);
MbElement mqDestinationList = destination.createElementAsFirstChild(MbElement.TYPE_NAME, "MQDestinationList", null);
mqDestinationList.createElementAsFirstChild(MbElement.TYPE_NAME, "DestinationData", null);
```

- Avoid concatenating `java.lang.String` objects as this is very expensive since it (internally) involves creating a new `String` object for each concatenation. It is better to use the `StringBuffer` class:

Instead of:

```
keyforCache = hostSystem + CommonFunctions.separator + sourceQueueValue +
CommonFunctions.separator + smiKey + CommonFunctions.separator + newElement;
```

Use this:

```
StringBuffer keyforCacheBuf = new StringBuffer();
keyforCacheBuf.append(hostSystem);
keyforCacheBuf.append(CommonFunctions.separator);
keyforCacheBuf.append(sourceQueueValue);
keyforCacheBuf.append(CommonFunctions.separator);
keyforCacheBuf.append(smiKey);
keyforCacheBuf.append(CommonFunctions.separator);
keyforCacheBuf.append(newElement);
keyforCache = keyforCacheBuf.toString();
```

Tips for Coding XPath Efficiently



- Although XPath is a powerful statement from a development point of view it can have an unforeseen performance impact in that it will force a full parse of the input message. By default it will retrieve all instances of the search argument. If you know there is only one element or you only want the first then there is an optimization to allow this to happen. The benefit of using this is that it can save a lot of additional, unnecessary parsing.
- The XPath evaluation in Message Broker is written specifically for the product and has a couple of performance optimizations that are worth noting.
- XPath performance tips:
 - Use `/aaa[1]` if you just want the first one
 - It will stop searching when it finds it
 - Avoid descendant-or-self (`//`) if possible
 - It traverses (and parses) the whole message
 - Use `/descendant::aaa[1]` instead of `(//aaa)[1]`

Measure your flows



- How to drive load?
- Where possible DON'T preload queues
 - Unrealistic
 - Inefficient
- **Use Performance Harness for JMS**
 - This is the same tool that the WebSphere Message Broker and WebSphere MQ teams use when measuring the products.
- Available to download on Alphaworks:
 - <http://www.alphaworks.ibm.com/tech/perfharness>
- Supports testing JMS, MQ, HTTP, SOAP
- The tool provides:
 - Throttled operation (fixed rate or number of messages)
 - Multiple destinations
 - Live performance reporting
 - JNDI
 - Non JNDI for IBM JMS Providers

Performance Harness – MQ



- Module to put messages to queues “-tc mqjava.Sender”
- Module to get messages from queues “-tc mqjava.Receiver “
- Module to measure round trips (put then get) “-tc mqjava.Requestor”
 - Persistent, transacted point-to-point Send and Receive using the mqjava.Requestor using 5 clients. The message file referenced is one that contains an RFH2 header at the start as produced from RFHUtil SupportPac IH03. Each client will send a message to INPUTQUEUE and wait for a response on the OUTPUTQUEUE. The tool will run for 120 secs and print stats every 5 seconds.

```
java JMSPerfHarness -tc mqjava.Requestor -iq INPUTQUEUE -oq  
OUTPUTQUEUE -r1 120 -jb QM_RED -jh server1 -jp 1414 -mf  
c:/Input_XML.msg -rf 2 -ss 5 -nt 5 -pp -tx
```

- Module to act as a responder (get then put) -tc “mqjava.Responder”

Performance Harness – JMS



- Module to put JMS messages to queues – “-tc jms.r11.Sender ”
- Module to get JMS messages from queues – “-tc jms.r11.Receiver ”
- Module to measure round trips (put then get) –“-tc jms.r11.Requestor”

```
java JMSPerfHarness -tc jms.r11.Requestor -iq CSIM_SERVER_IN_Q -oq  
CSIM_COMMON_REPLY_Q -pc JNDI -cf HOUNDQCF -ii  
com.sun.jndi.fscontext.RefFSContextFactory -iu file:/i:/JMS/JNDI -  
to 30000 -mt bytes -mf i:\InputMessages\input_gen_xml_4k.xml -nt  
40 -ss 3 -rl 310
```

- Module to act as a responder (get then put) – “-tc jms.r11.Responder”
- Module to act as a Publisher – “-tc jms.r11.Publisher ”
- Module to act as a Subscriber – “-tc jms.r11.Subscriber ”

Performance Harness – SOAP/HTTP



- Module to send HTTP Requests
- SOAP can be tested using precanned SOAP messages from files.
- Driving a HTTP Input Node. An example invocation is shown below which will start one http client thread against the URL "http://10.16.112.39:7080/test". The test will run for 120 secs and will print out message rates every 10 seconds.

```
java JMSPerfHarness -tc http.HTTPRequestor -jh 10.16.112.39 -jp 7080 -ss 10 -nt 1 -mf E:\input.xml -wi 50 -to 500000 -ur test -wo 10000 -rl 120
```

- Driving SOAP Input Node. The example shown below will start 20 http client threads against the URL "http://hound:7800/WssSale/services/WssSale". The test will run for 310 secs and will print out message rates every 3 seconds. It will set the SOAPAction header to be "SummerSale".

```
java JMSPerfHarness -tc http.HTTPRequestor -jp 7800 -wi 100 -to 50000 -jh HOUND -sa SummerSale -mf i:\InputMessages\SOAP_Sale_4K.xml -nt 20 -ss 3 -rl 310 -ur WssSale/services/WssSale
```

Running Perfharness



- Requires Java 5 minimum
- Requires WMQ v7 (but v6 is supported in Perfharness v1.0)
- Set min and max heap size for the tool: **-ms256M -mx256M**
- Set the Classpath: **-cp**
`./jars/perfharness.jar; .\jars\providerutil.jar; .\jars\com.ibm.mqjms.jar; .\jars\ldap.jar; .\jars\jta.jar; .\jars\jndi.jar; .\jars\jms.jar; .\jars\connector.jar; .\jars\fscontext.jar; .\jars\com.ibm.mq.jar;`

- **Example Output:**

```
Sender1: START
```

```
rateR=3137.33,threads=1
```

```
rateR=4488.75,threads=1
```

```
rateR=4621.33,threads=1
```

```
rateR=4680.78,threads=1
```

```
rateR=4683.67,threads=1
```

```
rateR=4693.88,threads=1
```

```
rateR=4683.56,threads=1
```

```
Sender1: STOP
```

```
totalIterations=128133,avgDuration=26.53,maxrateR=4683.56
```

```
ControlThread1: STOP
```

Analyse your flows costs

Is my flow CPU or I/O bound?



- Run your flow under load and use OS tools to determine if the flow is CPU or I/O Bound:
 - Windows – use “perfmon”
 - Unix – use “vmstat” or “top”
 - z/OS – Use “SDSF”
- Generally in a CPU bound flow if driven hard enough 1 flow instance can consume 1 CPU/core. If this is not the case its likely to be I/O bound.
- These results will show you if the flow is CPU or I/O bound and give you a hint on what broker stats to look for: Elapsed time vs CPU time.
- This information will help you understand the likely impact of:
 - Scaling e.g. additional instances
 - Faster Storage
 - Faster networks

Accounting and Statistics



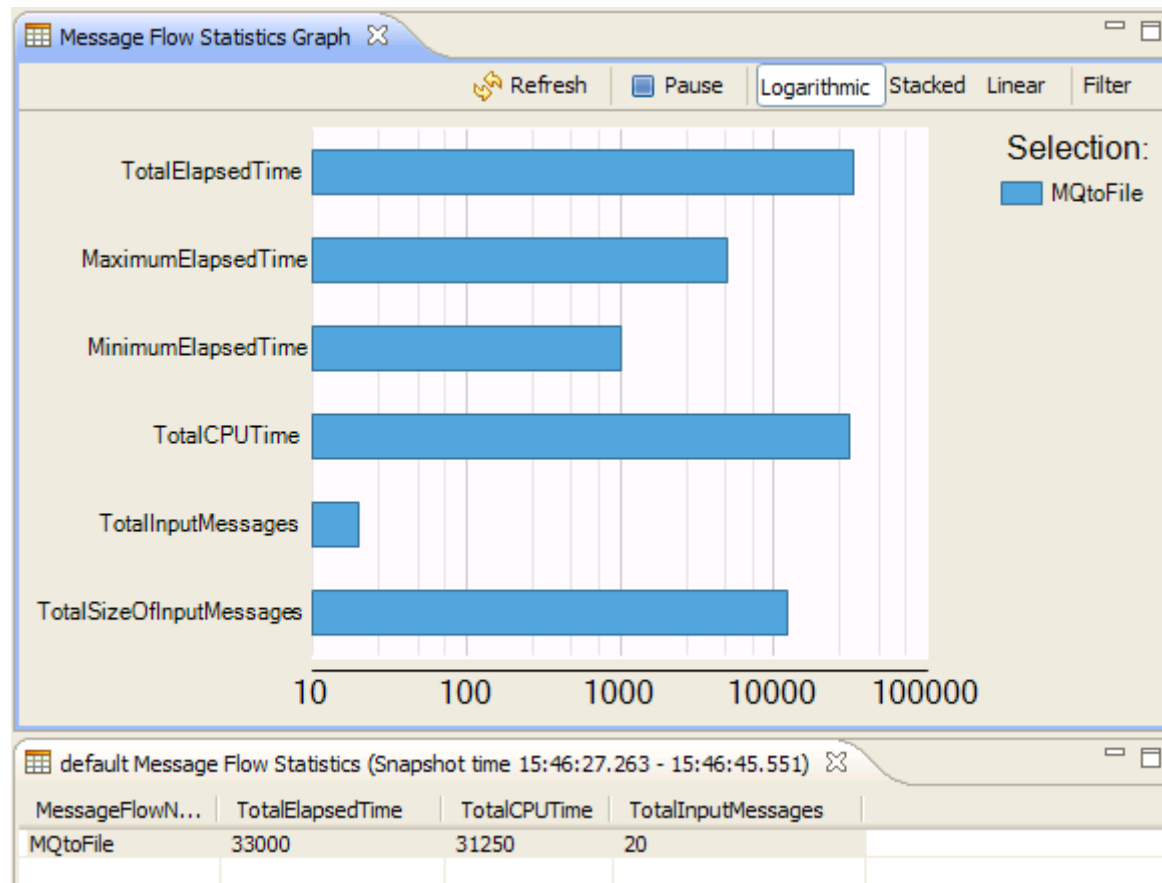
Statistics	▶ Start Message Flow Statistics
	▶ Stop Message Flow Statistics
	▶ Open Statistics Views
User Trace All Flows	▶
Trace Nodes All Flows	▶
Service Trace	▶ Start Resource Statistics
Flow Debug Port	▶ Stop Resource Statistics
	▶ Open Resource Views

MQ Explorer - Content testbrk Administration Log

Execution Group default

Warning: Performance Impact - Statistics Reporting active

- MBE Explorer enables you to start/stop message flow statistics on the broker, and view the output.
- Warnings are displayed advising there may be a performance impact.



Accounting and Statistics – using MB Explorer



- Enable stats on the flows of concern or all
- Likely overhead ~3% (see performance reports)
- Start at the broker level and work down to EG's->flows->nodes
- For CPU bound flows focus on “Total CPU time” on nodes
- For I/O bound flows look for “Total Elapsed time” on nodes
- MB Explorer will show you where to focus your efforts

Resource Statistics



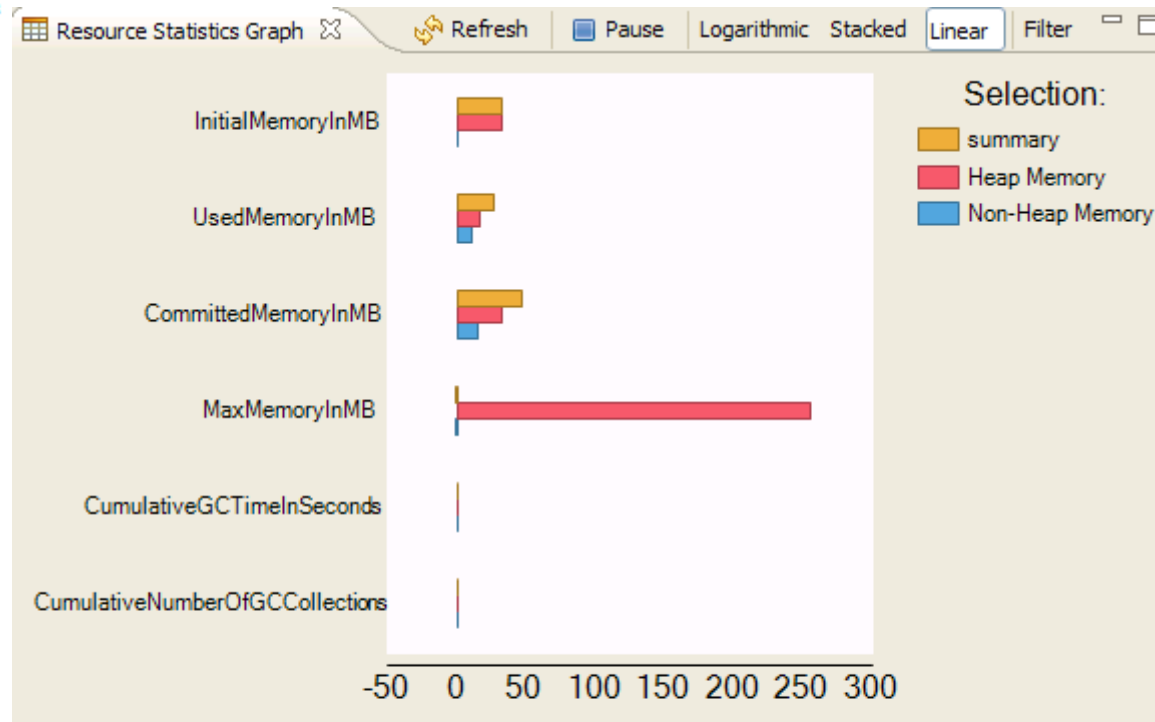
Statistics	Start Message Flow Statistics
	Stop Message Flow Statistics
	Open Statistics Views
User Trace All Flows	Start Resource Statistics
Trace Nodes All Flows	Stop Resource Statistics
Service Trace	Open Resource Views
Flow Debug Port	

MQ Explorer - Content testbrk Administration Log

Execution Group default

Warning: Performance Impact - Statistics Reporting active

- M Explorer enables you to start/stop resource statistics on the broker, and view the output.
- Warnings are displayed advising there may be a performance impact.



default Resources Statistics (Snapshot time 15:46:29 - 15:46:49)

	CICS	CORBA	FTEAgent	JDBCConnectionPools	JVM	ODBC	SOAPInput	Security	Sockets
name									
summary					32	27	47	-1	0
Heap Memory					32	16	32	256	
Non-Heap Mem...					0	11	15	-1	
Garbage Collect...									0

Resource Statistics – using MB Explorer



- Enable stats on the EG of concern
- Minimal overhead of ~1% (see performance reports)
- Focus on the resource areas your flow is dependent on (Java, Sockets etc)
- MB Explorer will show you where to focus your efforts

Some other useful tools:

- MQExplorer – QM Admin and useful to monitor queue depths during tests
- RFHUtil – useful to set MQMD and RFH headers. Shows message content
 - Note: Perfharness can send messages with RFH headers generated by RFHUtil
- NetTool – useful for simple request/reply tests for HTTP/SOAP. Shows message content
- Filemon – windows tool to show which files are in use by which processes

Making and Testing Changes - Methodology



- Run driver app (perfharness) on a machine separate to broker machine
- Test flows in isolation
- Use real data where possible
- Use a controlled environment – access, code, software, hardware
- Take a baseline before any changes are made
- Make ONE change at a time.
 - Where possible retest after each change to measure impact
- Start with a single flow instance/EG and then increase to measure scaling and processing characteristics of your flows

Agenda

- Introduction
- What are the main costs in message flows?
- What are the best practises to avoid those costs?
- Identifying and making improvements
- **Performance Reports**
- V7 Improvements
- Summary

Performance Reports

- All Performance Reports :

<http://www-1.ibm.com/support/docview.wss?uid=swg27007150>

- Latest reports for v7:

Platform	SupportPac Number
AIX	IP6N
xLinux	IPL6

- Lots of v6.1 and v6 reports.

Performance Reports: How do I use the reports?



Consists of 2 Sections

- High level release highlights and use case throughput numbers
 - Use to see what new improvements there are
 - Use to see what kind of rates are achievable in common scenarios
 - Numbers in this section can be replicated in your environment using product samples and performance
- Detailed low level metrics (nodes/parsers)
 - Use to compare parsers
 - Use to compare persistent vs non-persistent
 - Use to compare transports
 - Use to compare transformation options
 - Use to see scaling and overhead characteristics
 - Shows tuning and testing setup
- **Please feedback to us if they are useful or not and if there is any new content required!**

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- Introduction
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WebSphere Message Broker v7 Performance

- Performance continues to be a key focus
- Overall performance increase of 5% over v6.1
- 64bit on all platforms
- Removal of the Configuration Manager and User Name Server
- Significant improvement in deployment times, with v7 in some scenarios taking only 23% of the time taken in v6.1 to complete the same deployment
- Significant improvement in toolkit connect times, with v7 in some scenarios taking only 8% of the time taken in v6.1 to complete the same connection
- Business-level monitoring improvements of between 30% and 50% over v6.1.0.3

Summary

- Understand the costs in broker
- Understand the best practises to avoid these costs
- Use appropriate tools to measure and analyse your flows to look for improvements
- Use the performance reports

Thanks for Listening!