IBM Software Group

Tracing WebSphere's Service Integration Bus For Your Own Use

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WebSphere® Support Technical Exchange

Agenda

- Service Integration Bus: A quick overview
- Tools used for diagnostic data collection and analysis:
  - IBM Support Assistant for Data Collection (ISADC)
  - WebSphere Application Server (WAS) Trace Analyzer
- Preparation for WAS Tracing
- SIB Trace Strings
- Tracing JMS™ Format And Protocol (JFAP) Channel and SIB Communications
- Tracing Messages
- Tracing SIB Database Interaction

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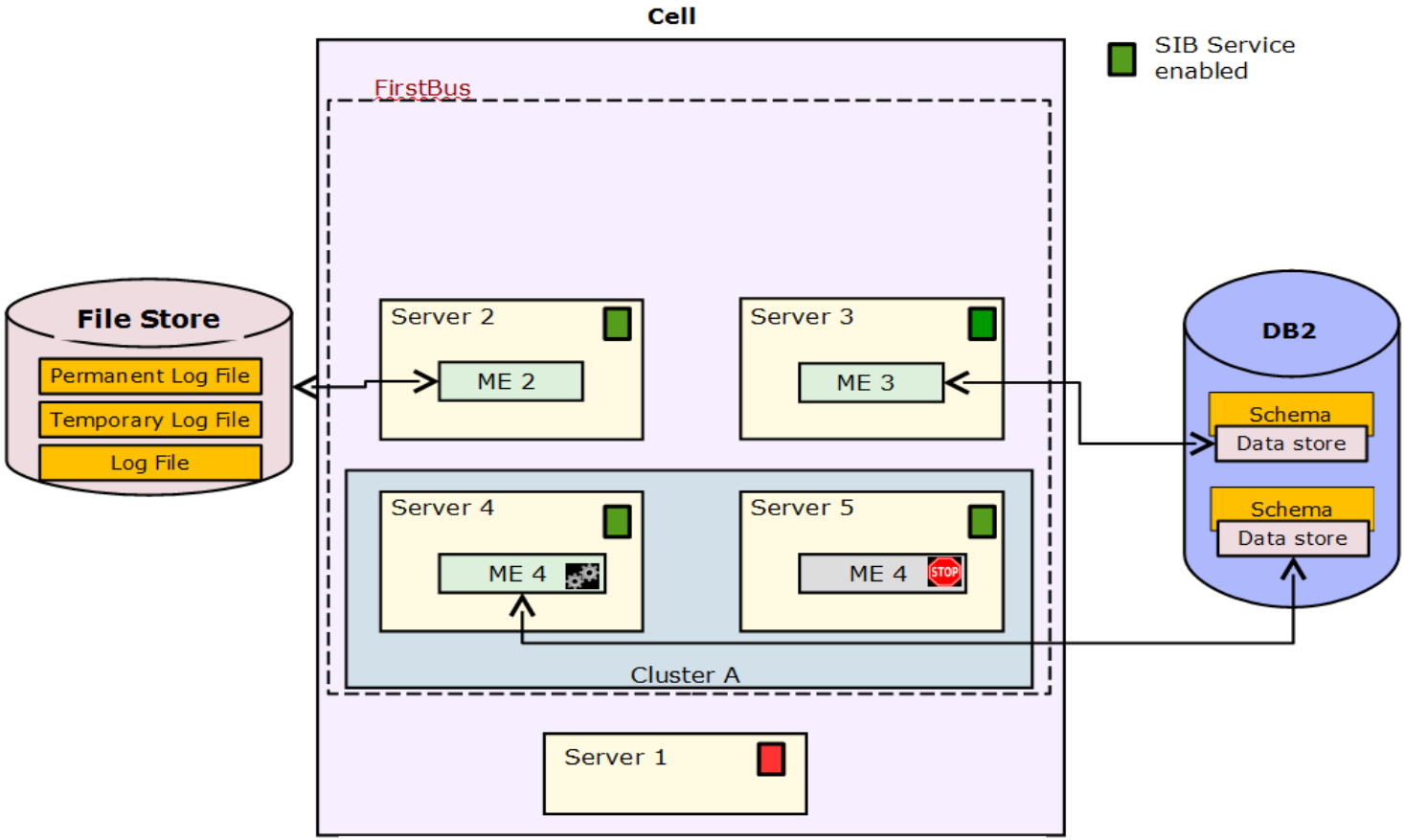
Service Integration Bus (SIB): Overview

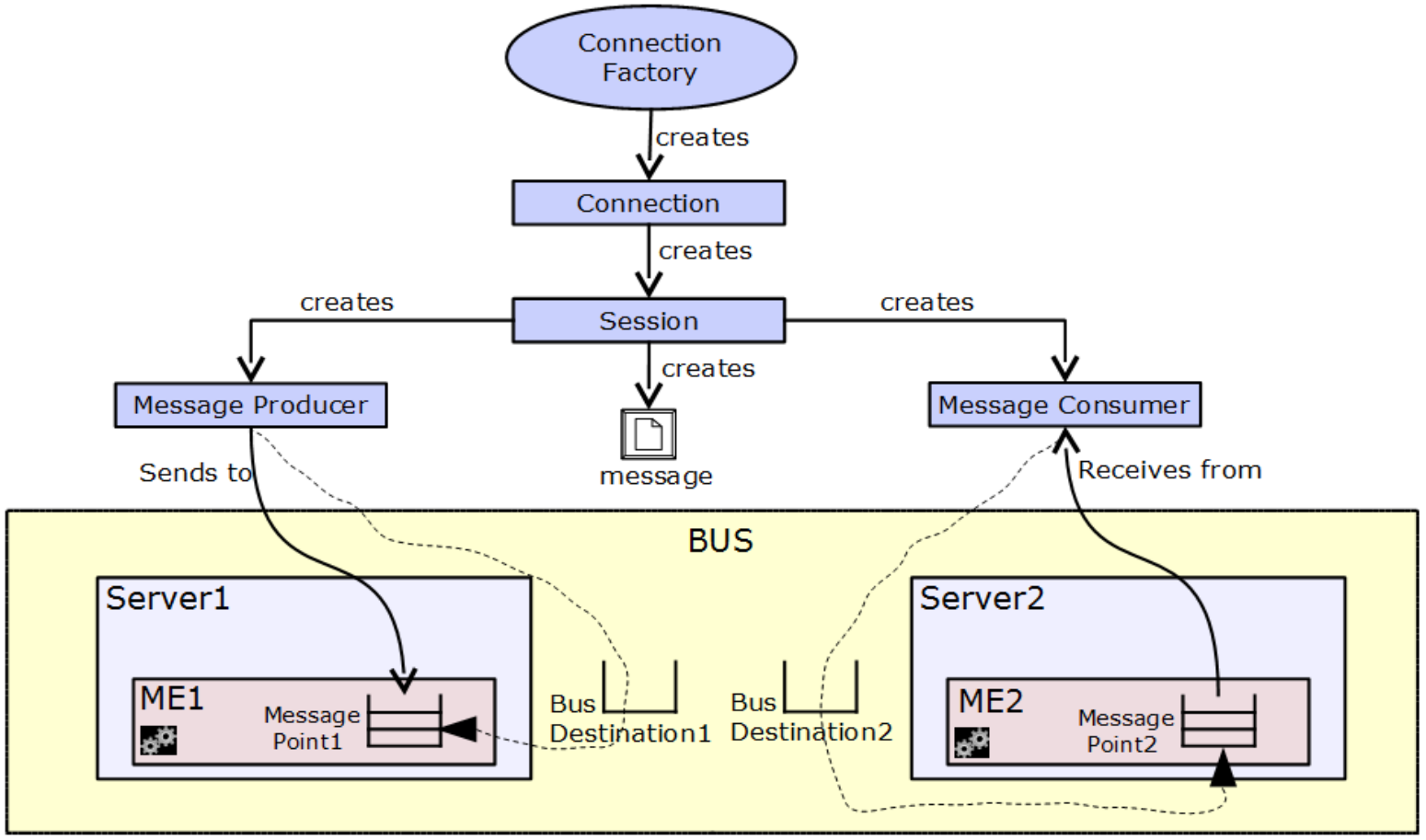
The Service Integration Bus is the implementation of the WAS Default Messaging Provider. It is therefore a key component on which other IBM products rely, including WebSphere Process Server, WebSphere Portal, and Maximo® Asset Management. Its main components are:

- **Bus**: A group of interconnected servers, clusters and WMQ servers that become bus members.
- **Messaging Engine (ME)**: Lightweight runtime component that runs inside an application server. It provides core messaging functionality of a bus. MEs inside a bus work together to create the illusion of the concept of a bus.
- **Sib Service**: An application server component responsible for managing (i) all of the messaging resources within an application server, (ii) the life cycle of any defined messaging-related transport chains and (iii) handles inbound connection requests from external messaging applications.
- **Destination (queue or topic)**: A logical address to which applications can attach to in order to exchange messages. It gets associated with a physical address, called **message point**, where messages actually end up in.
- **Message store (file store or data store)**: Used by the ME to preserve both, its volatile and durable data.

SIB Topology: Example



JMS API Programming Model



JMS™

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IBM Support Assistant Data Collector (ISADC)

- Bundled in WAS V8.5 and later: Interactive way of collecting a COMPLETE mustgather data, for IBM and/or your own use. http://www.ibm.com/support/docview.wss?uid=swg21145599
- Can be invoked through web browser or command line prompt: index.html and isadc.bat/sh are both located in the <WAS_ROOT>\ISADC directory.
- Useful for diagnosing problems of over 50 WAS components.
- For SIB problems, choose options 'Connectors' than 'JMS Problems'.

<WAS_ROOT>\isadc\isadc.bat(.sh)

```
c:\Program Files (x86)\IBM\WebSphere\AppServer8.5.5\isadc>isadc


Starting IBM Support Assistant Data Collector in console mode... NOTE: On
supported platforms you have the option to run data collection in a web
browser. This can be done by opening the file index.html in a web
browser. See the release notes for a list of platforms where data
collection is supported in a web browser.

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trademark of IBM Corporation in the United States, other countries, or
both.

ApplicationServer: 2.0.11.20140701
IBM Support Assistant Data Collector:
2.0.2.GA20140408-1111
Common Inventory Sub Agent: 6.3.0.20120123


Provide a file name for saving the collected data or press enter to
generate a unique file name:
>
```
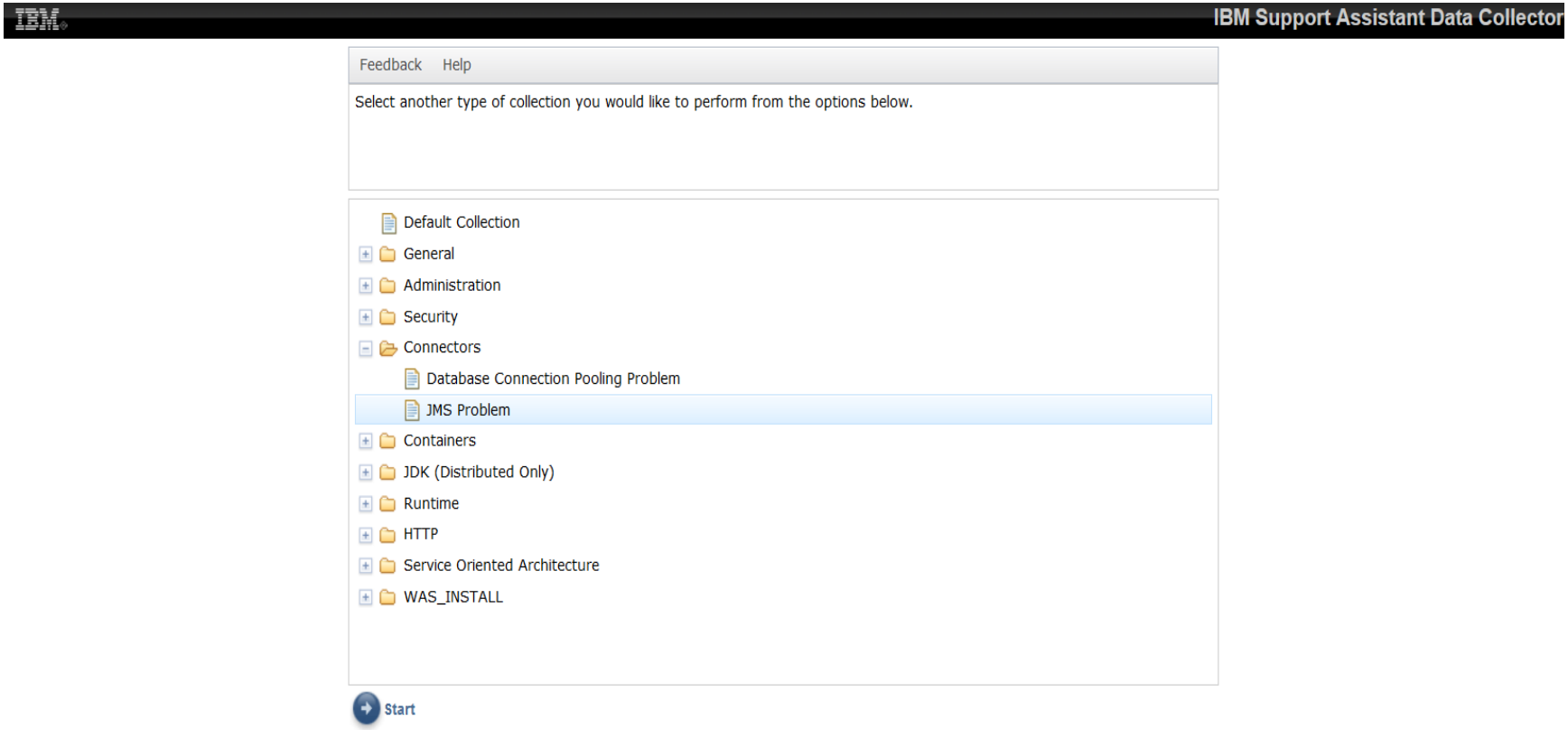

<WAS_ROOT>\isadc\index.html



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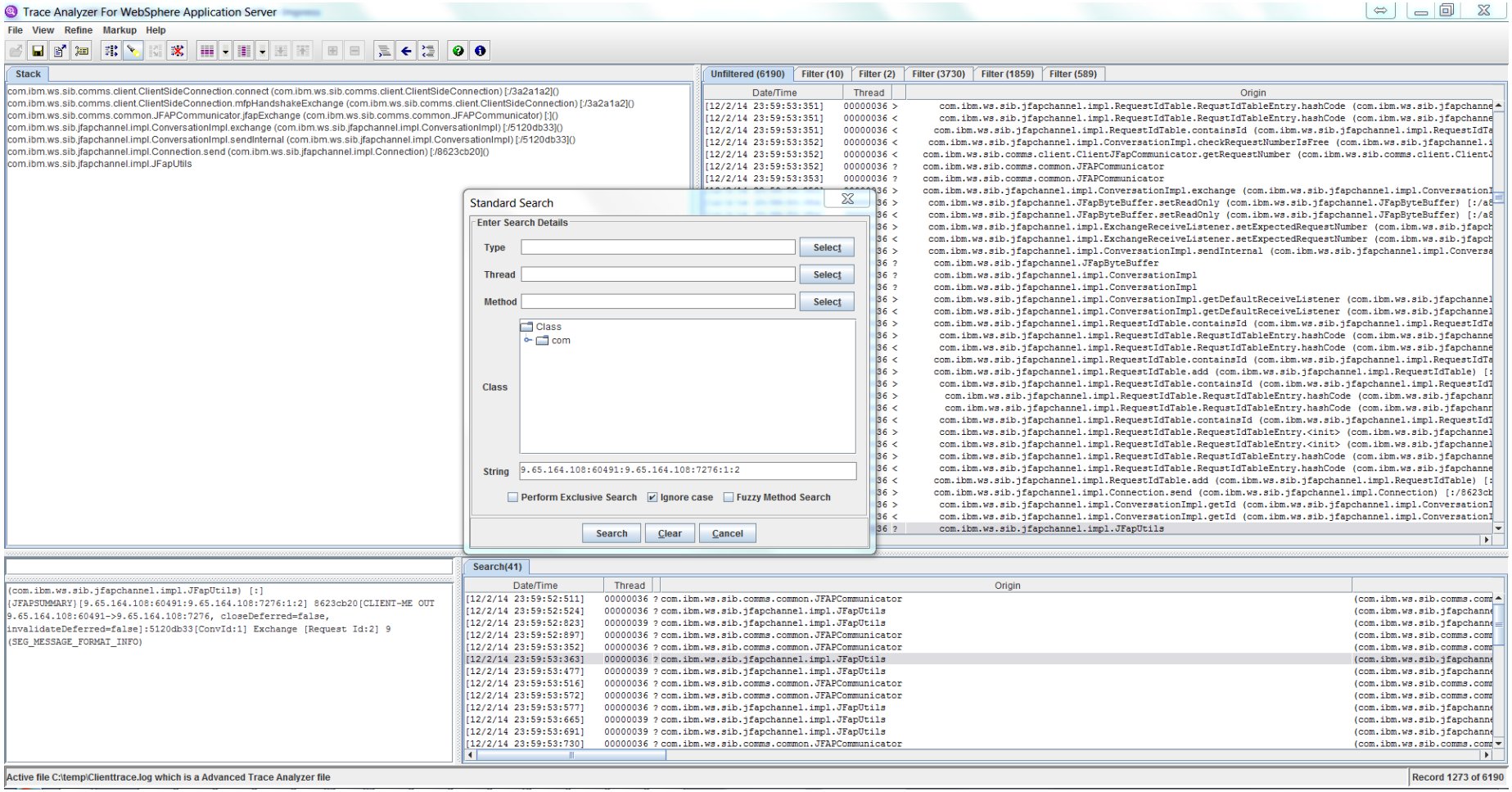
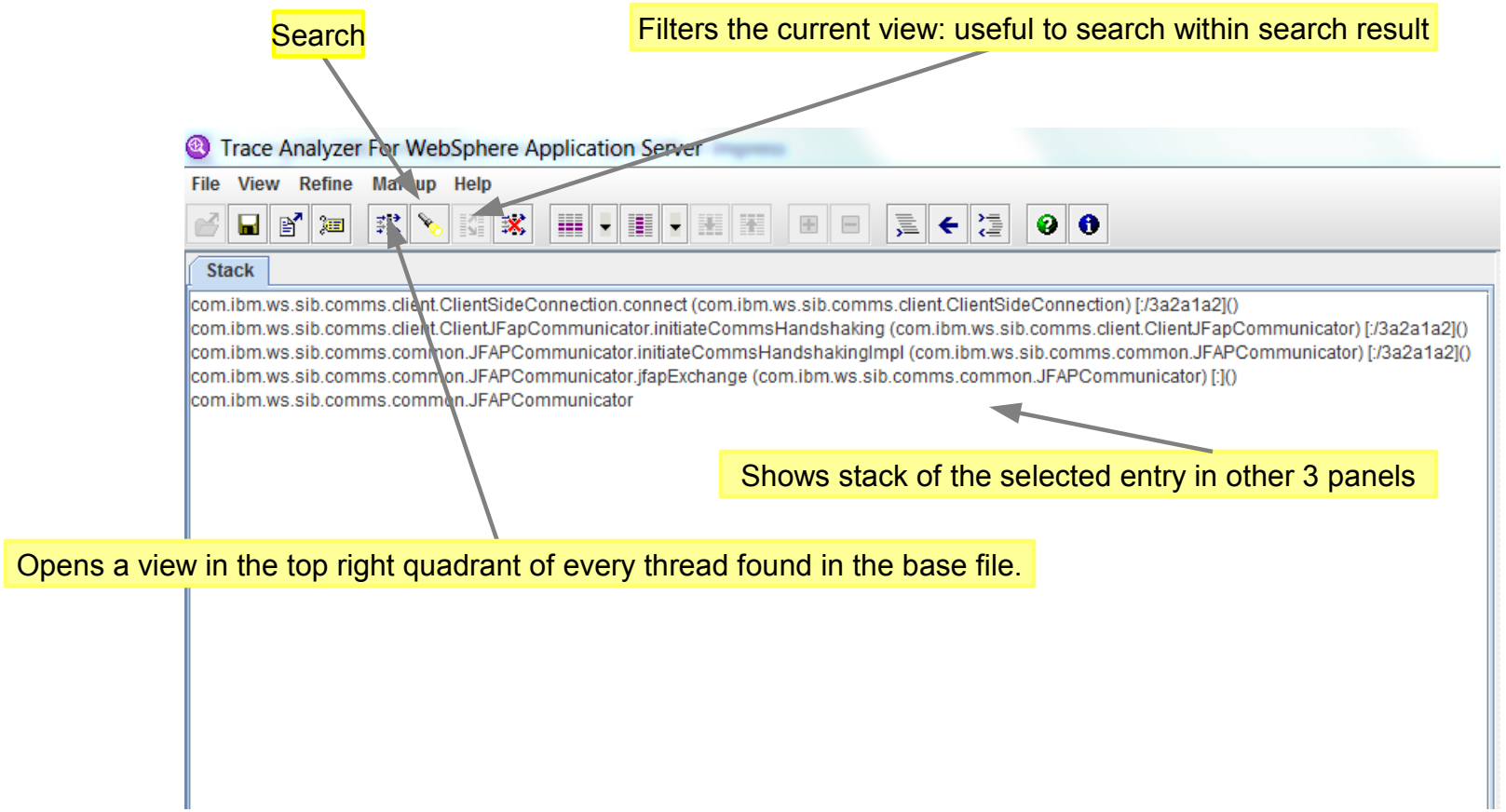
Trace Analyzer

- Trace Analyzer for WebSphere Application Server was initially created by IBM
- Trace Analyzer is not supported by IBM
- It is now available on the Internet, as is, at: www.softpedia.com
- The tool is very easy to use, experimenting with the different search options is a good place to start
- It can also be used to search SystemOut.log files
- Trace Analyzer is still used internally by some IBMers

Trace Analyzer Interface



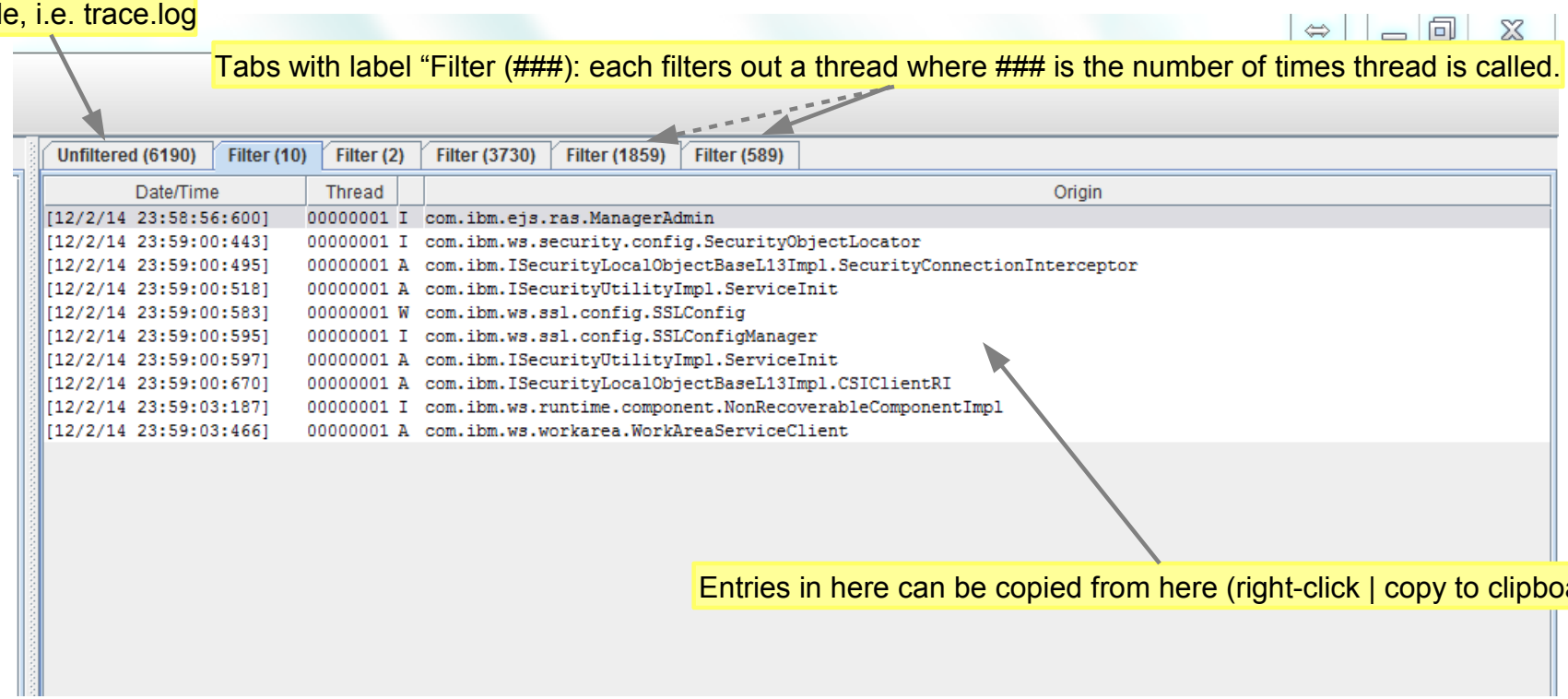
Trace Analyzer : Top left panel



Trace Analyzer : Top right panel

Base file, i.e. trace.log

Tabs with label “Filter (###): each filters out a thread where ### is the number of times thread is called.

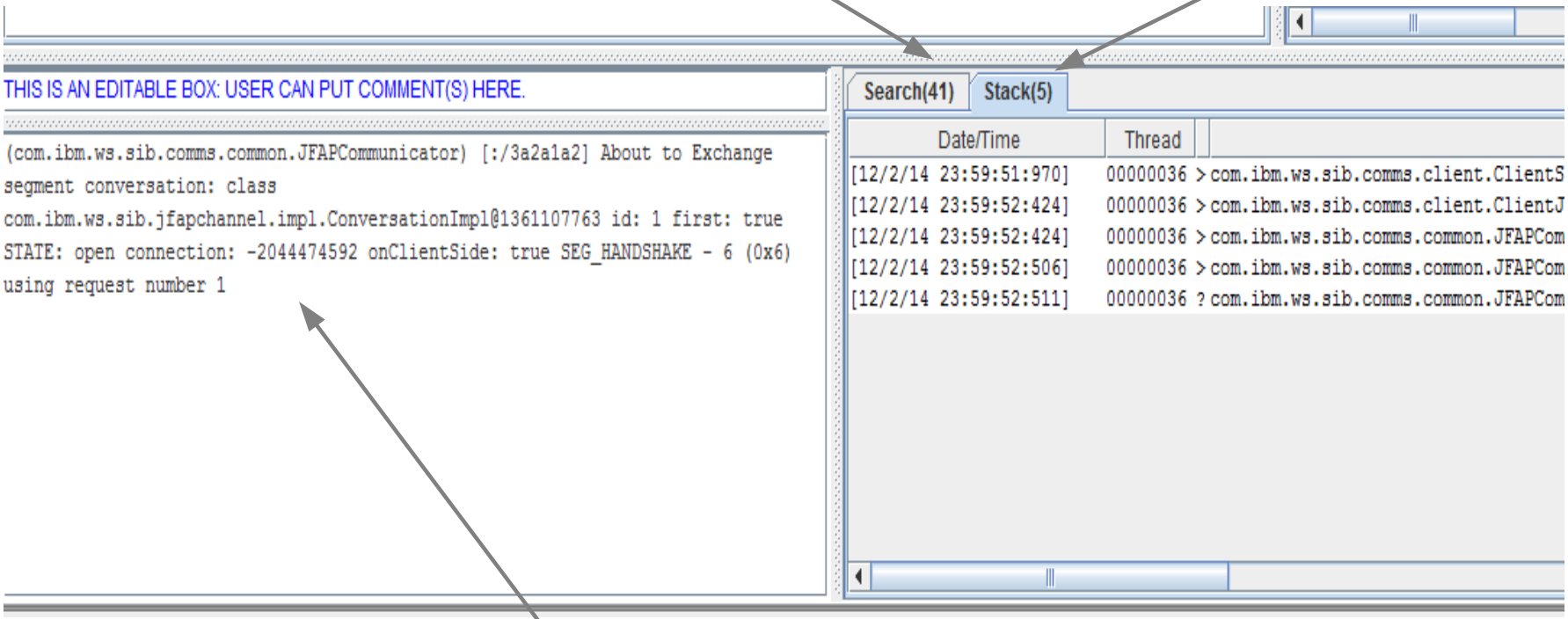


Entries in here can be copied from here (right-click | copy to clipboard)

Trace Analyzer: Bottom left & right panels

Search tab gets created to display search result.

Displays stack results of a selected entry from the top right panel



Displays return value (result) of the selected entry in other panel. If no applicable return, the clock time it took for that call to execute is displayed.

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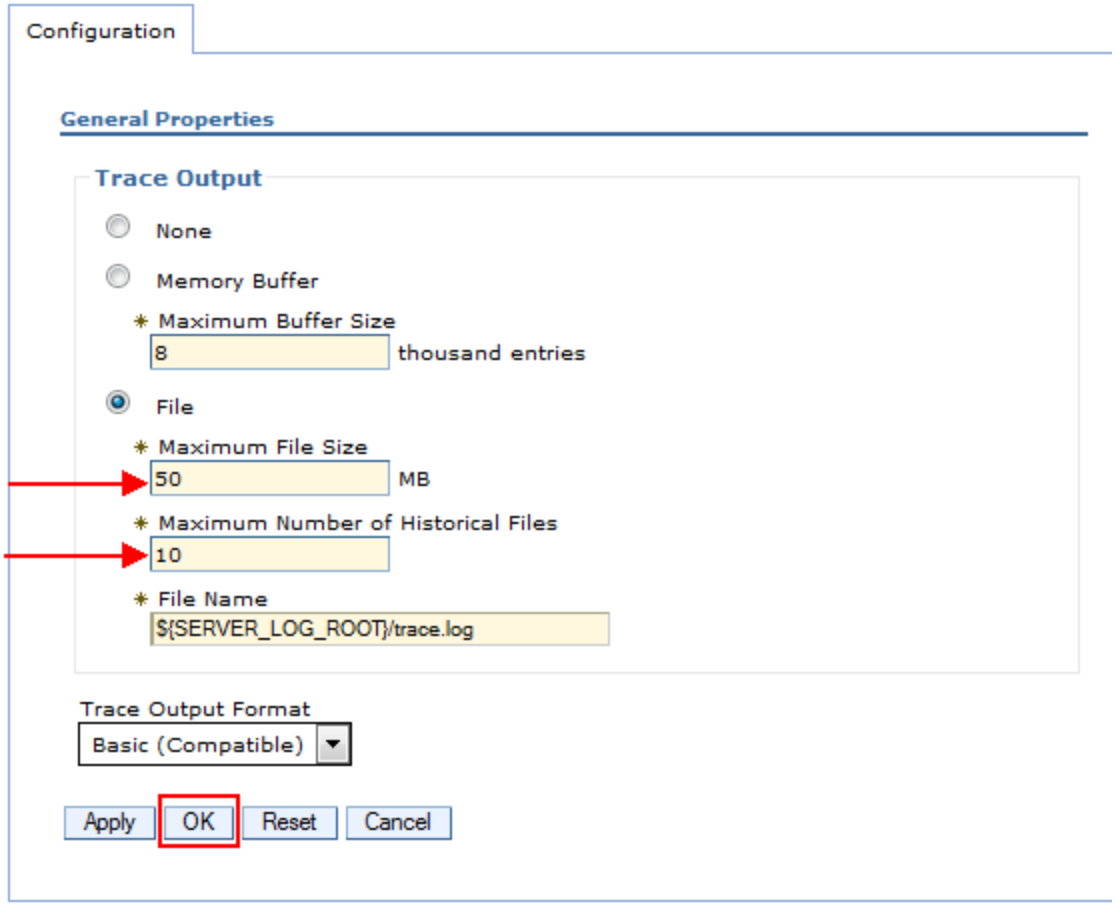
Preparation for WAS Tracing

- Tracing records code actions
- All activity is stored on disk
- Potential Performance Hit
- Needs to run where, and when, the problem occurs
- Better to have too much trace than too little
- The default sizes for trace files may result in the files being overwritten
- They can be increased by navigating to this location in the admin console:
  - Troubleshooting > Logging and tracing > YOUR_JVM > Diagnostic trace service

JVM™

Trace File sizes

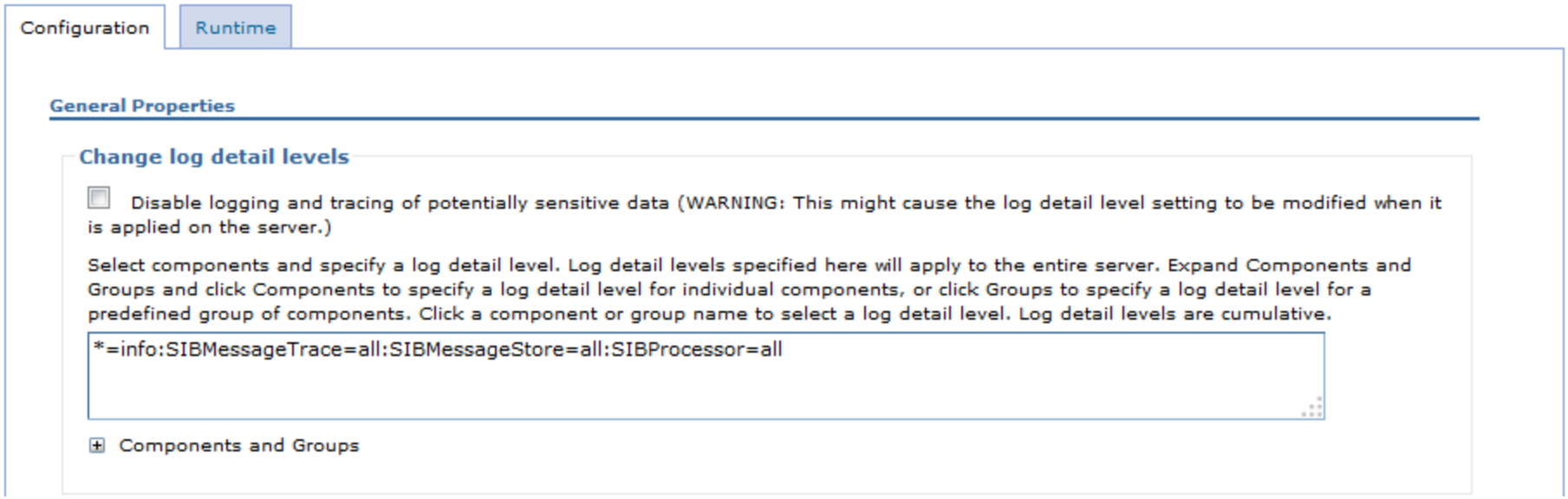


JVM Logs

- JVM logs should be set so that they will correspond to whatever happens in the Trace.
- Use the same settings: 10 files at 50 MB each
  - Troubleshooting > Logging and tracing > JVM_NAME > JVM Logs

Entering Trace Strings

- In the admin console, navigate to:
  Troubleshooting > Logging and tracing > JVM_NAME > Change log detail levels
- Select either Configuration or Runtime tab and enter the string in the box



IBM Level 2 Support

- If you need L2 support the SIB team has the following recommendations:
- Use 50 MB as your standard trace size when submitting to IBM
- Be aware that Level 3 support may still ask for files up to 200 MB in size
- The best link to use when submitting files to IBM: https://www.ecurep.ibm.com/app/upload
- Always send complete files, never edit them
- Let IBM decide what should be sent

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SIB Trace Strings

- Trace strings tell WebSphere what code action to record. For example:
  - SIBSecurity=all:SIBJms*=all
- The above string records all SIB security code actions and anything which begins with SIBJms, such as: SIBJmsRa and SIBJms_External
- The strings are separated by a ":"
- *=info is automatically pre-pended, so the above string becomes *=info:SIBSecurity=all:SIBJms*=all

More Trace Strings

- The SIB mustgather site contains instructions, which include trace strings, for many aspects of SIB
- Check out the website: http://www.ibm.com/support/docview.wss?uid=swg21266769

Message Prefixes 1

Message prefix	SIB Component	Trace String
CWSIA	API	SIBJms*=all
CWSIB	Message formatting and parsing core	SIBMfpApi=all
CWSIC	Communications	SIBCommunications*=all
CWSID	Administration and system management	SIBAdmin=all
CWSIE	Message formatting and parsing SPI	SIBMfpApi=all
CWSIF	Message formatting and parsing	SIBMfp*=all
CWSIG	Example	SIBExample=all
CWSIH	Match space	SIBMatchSpace=all
CWSII	Security	SIBSecurity=all
CWSIJ	Communications formats and protocol	SIBJFapChannel=all

Message Prefixes 2

Message prefix	SIB Component	Trace String
CWSIA	API	`SIBJms*=all`
CWSIB	Message formatting and parsing core	`SIBMfpApi=all`
CWSIC	Communications	`SIBCommunications*=all`
CWSID	Administration and system management	`SIBAdmin=all`
CWSIE	Message formatting and parsing SPI	`SIBMfpApi=all`
CWSIF	Message formatting and parsing	`SIBMfp*=all`
CWSIG	Example	`SIBExample=all`
CWSIH	Match space	`SIBMatchSpace=all`
CWSII	Security	`SIBSecurity=all`
CWSIJ	Communications formats and protocol	`SIBJFapChannel=all`

Message Prefixes 3

Message prefix	SIB Component	Trace String
CWSIK	Common messages	`SIBAdmin=all:SIBMfp*=all: SIBProcessor=all`
CWSIL	Publish and subscribe bridge	`SIBPsb=all`
CWSIM	Mediations	`SIBMediations=all`
CWSIN	Mediation services	`SIBMediations=all`
CWSIO	Administration migration	`SIBMigrationUtil=all`
CWSIP	Message processor	`SIBProcessor=all`
CWSIQ	MQ formats and protocol	`SIBMqFapChannel=all`
CWSIR	Core programming interface	`SIBProcessor=all`
CWSIS	Message store	`SIBMessageStore=all`
CWSIT	Topology routing and management	`SIBTrm=all`

Message Prefixes 4

Message prefix	SIB Component	Trace String
CWSIU	Utilities	SIBUtils=all
CWSIV	Resource adapter	SIBJmsRaCommon=all
CWSIX	Core beans	Not traceable at present
CWSIY	Mediation handler framework	SIBMediations=all
CWSIZ	Mediation framework	SIBMediations=all
CWSJA	Administration commands	SIBAdmin=all
CWSJB	Inter-bus link	SIBIbl=all
CWSJC	Core selector	Check with SIB Level 2 Support
CWSJD	Administration security	SIBSecurity=all

Message Prefixes 5

Message prefix	SIB Component	Trace String
CWSJO	Service Data Objects configuration	`SIBSdoRepository=all`
CWSJQ	Message formatting and parsing MQ interoperability	`SIBMfpMq=all`
CWSJR	Resource adapter (JMS)	`SIBJmsRa=all`
CWSJU	Message tracing	`SIBProcessor=all`
CWSJW	WLM classifier for z/OS	`SIBWlmClassifier=all`

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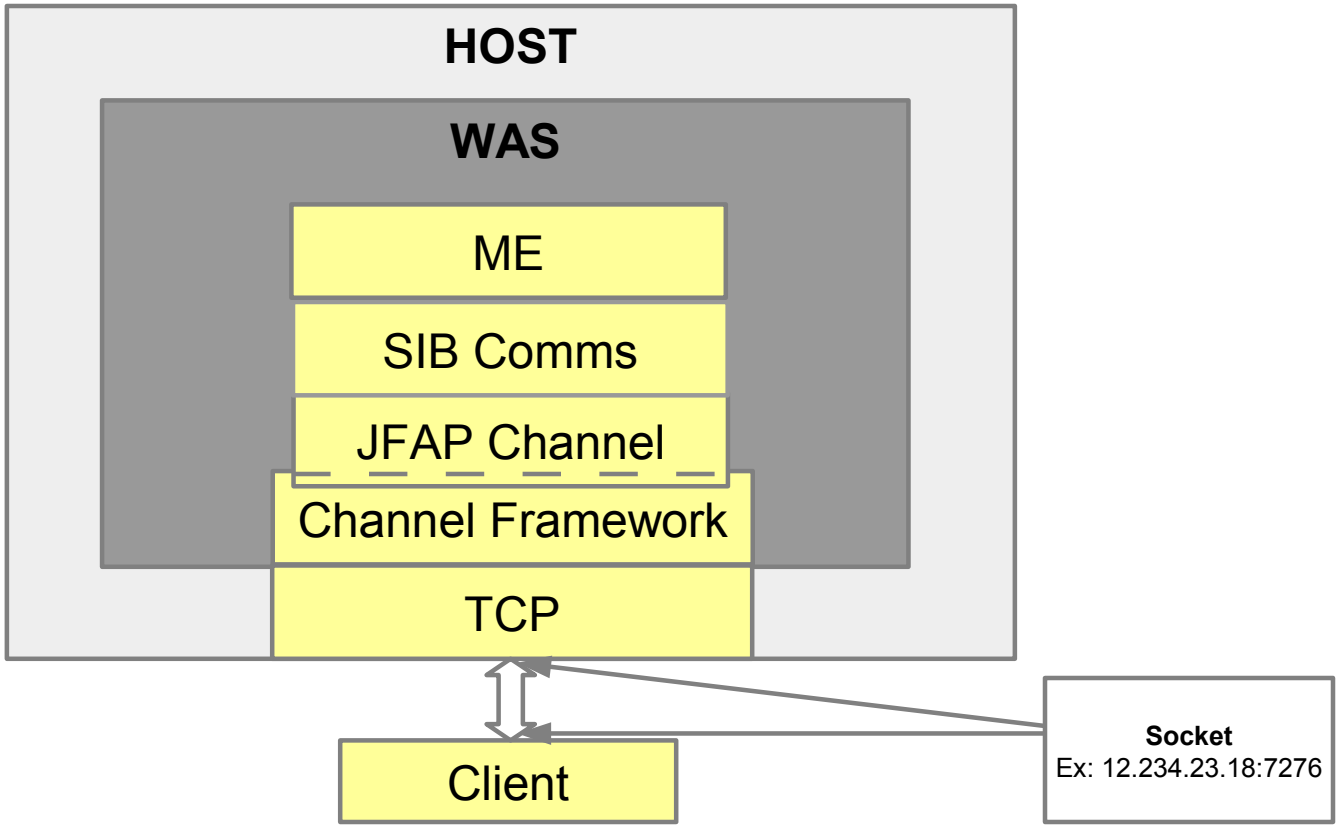
Networking Services, Protocol and I/O operations between client and ME



Test Environment

- Client: Launched SIB client application that:
  - Creates a physical connection
  - Creates a producer session,
  - Sends 3 messages in a row and then
  - Closes everything.
- ME server: ME (non-local to the client) runs on a server bus member.
- Trace specifications used on both sides:

*=info:SIBCommunications=all:SIBJFapChannel=all

Trace Strings

- Trace groups used on both ends:

  *=info:SIBJFapChannel=all:SIBCommunications=all

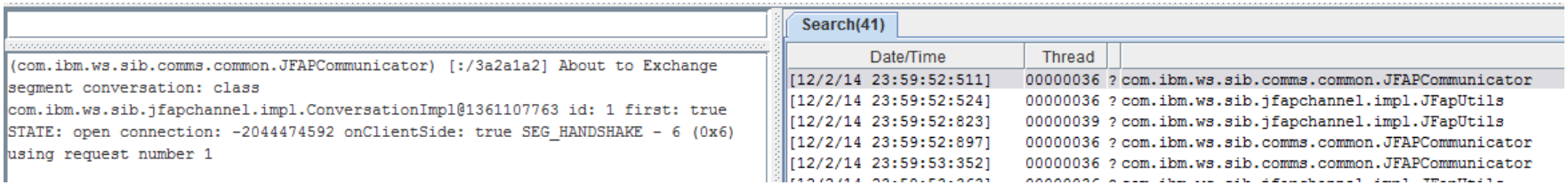
  - JFAP Exchange: Tracking physical connection and its details, conversations and, requests.
  - SIB Comms: Tracking communications between the JfapChannel and the ME

Trace Strings - continue

- JFapChannel trace group tracks the actual connection between the ME and the client:
  - JFAP: Communications between a SIB application and a remote ME are supported by the WAS channel framework via the JMS Format And Protocol (JFAP).
- SIBCommunications trace group (SIB comms) is the layer that sits between JFAP and the ME:
  - As far as message processing, the ME always sees the client as a local client.

JFap Exchange: On the client side

- Using Trace Analyzer, the best string to start your search with is: “SEG_”
- These are all communications (information exchange/commands) going on between the client and the ME to establish a connection, create/close producer/consumer session, send a message, get a response back and close the connection... : SEG_HANDSHAKE, SEG_MESSAGE_FORMAT_INFO, SEG_CONNECTION_INFO, SEG_TOPOLOGY, SEG_CREATE_PRODUCER_SESS_R, SEG_CREATE_PRODUCER_SESS



Tracking a Request

[12/2/14 23:59:52:316] 00000036 com.ibm.ws.sib.jfapchannel.impl.JFapUtils [(com.ibm.ws.sib.jfapchannel.impl.JFapUtils) [:] {JFAPSUMMARY} [**9.65.164.108:60491:9.65.164.108:7276::-1**] 8623cb20[OUT 9.65.164.108:60491->9.65.164.108:7276, closeDeferred=false, invalidateDeferred=false]:null[] New outbound connection established]

...

[12/2/14 23:59:53:934] 00000036 com.ibm.ws.sib.jfapchannel.impl.JFapUtils (com.ibm.ws.sib.jfapchannel.impl.JFapUtils) [:] {JFAPSUMMARY} [**9.65.164.108:60491:9.65.164.108:7276:1:5**] 8623cb20[CLIENT-ME OUT 9.65.164.108:60491->9.65.164.108:7276, closeDeferred=false, invalidateDeferred=false]:5120db33[ConvId:1] Exchange [Request Id:5] 48 (SEG_CREATE_PRODUCER_SESS)

- JFAPSUMMARY information shows the following:
  - "9.65.164.108:60491:9.65.164.108:7276" – The actual physical connection (socket to socket)
  - "9.65.164.108": IP address of the client, same as that of the ME.
  - "60491": Port used by the client.
  - "7276": Port on ME side, the SIB_ENDPOINT_ADDRESS port.
  - 1: Conversation id
  - 5: Request id

Example Request: Producer session

- [12/2/14 23:59:53:928] **00000036** com.ibm.ws.sib.comms.common.JFAPCommunicator (com.ibm.ws.sib.comms.common.JFAPCommunicator) [:/2b0e1b19] About to **Exchange** segment conversation: class com.ibm.ws.sib.jfapchannel.impl.ConversationImpl@1361107763 id: 1 first: true STATE: open connection: -2044474592 **onClientSide: true SEG_CREATE_PRODUCER_SESS** - 72 (0x48) using **request number 5**

- [12/2/14 23:59:53:934] 00000036 com.ibm.ws.sib.jfapchannel.impl.JFapUtils (com.ibm.ws.sib.jfapchannel.impl.JFapUtils) [:] **{JFAPSUMMARY}[9.65.164.108:60491:9.65.164.108:7276:1:5]** 8623cb20[CLIENT-ME OUT 9.65.164.108:60491->9.65.164.108:7276, closeDeferred=false, invalidateDeferred=false]:5120db33[ConvId:1] Exchange [Request Id:5] 48 (SEG_CREATE_PRODUCER_SESS)

- [12/2/14 23:59:53:982] **00000039** com.ibm.ws.sib.jfapchannel.impl.JFapUtils (com.ibm.ws.sib.jfapchannel.impl.JFapUtils) [:] {JFAPSUMMARY}[9.65.164.108:60491:9.65.164.108:7276:1:5] 8623cb20[CLIENT-ME OUT 9.65.164.108:60491->9.65.164.108:7276, closeDeferred=false, invalidateDeferred=false]:5120db33[ConvId:1] received conversation data with segment c8 (SEG_CREATE_PRODUCER_SESS**_R**)

- [12/2/14 23:59:53:992] 00000036 com.ibm.ws.sib.comms.common.JFAPCommunicator (com.ibm.ws.sib.comms.common.JFAPCommunicator) [:/2b0e1b19] **Exchange completed** successfully. Segment returned SEG_CREATE_PRODUCER_SESS_R - 200 (0xc8)

JFap Exchange: On the ME side

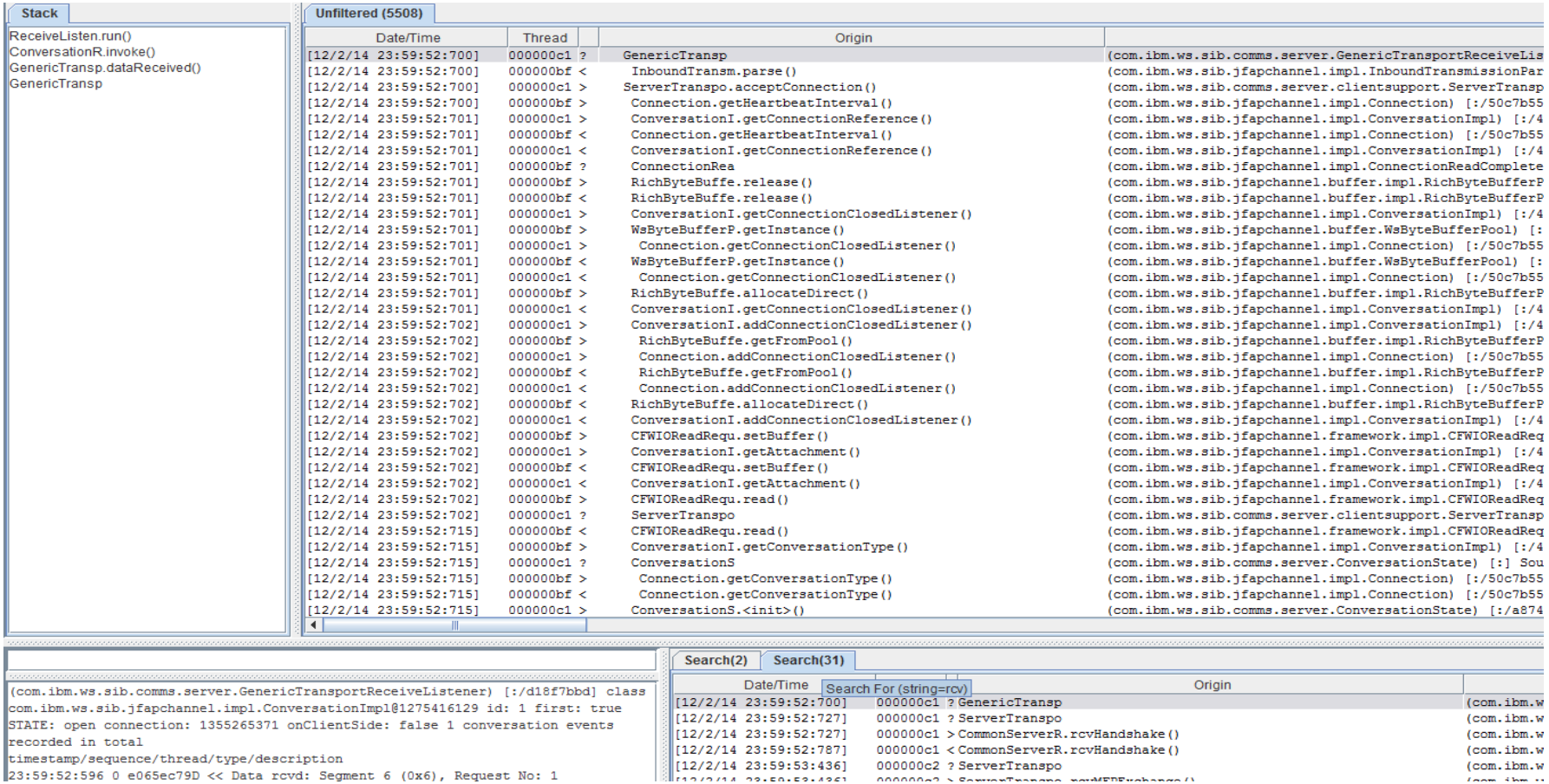
- Using Trace Analyzer, the best string to start your search with is the string "rcv" to see what the ME has received from the client.
- For my simple client application, I got 31 hits in a matter of a fraction of second.
- Look for the entry of method call "rcvCreateOrderContext" to view the new established connection (see bottom-left panel of the Trace Analyzer):

(com.ibm.ws.sib.comms.server.clientsupport.StaticCATConnection) [:] Entry
JFapByteBuffer@e24ecae6: { valid=false, released=false, dataList=[], receivedData=null, receivedBuffer=RichByteBufferImpl@c9aa64c8: PooledWsByteBufferImpl: ID: 33 java.nio.HeapByteBuffer[pos=0 lim=2 cap=32] Owner Count: 1 From pool: WSByteBufferPool: com.ibm.ws.buffermgmt.impl.WsByteBufferPool@2ba1756a buffer size: 32 }
class com.ibm.ws.sib.jfapchannel.impl.ConversationImpl@1275416129 id: 1 first: true
STATE: open connection: **1355265371 onClientSide: false**
4

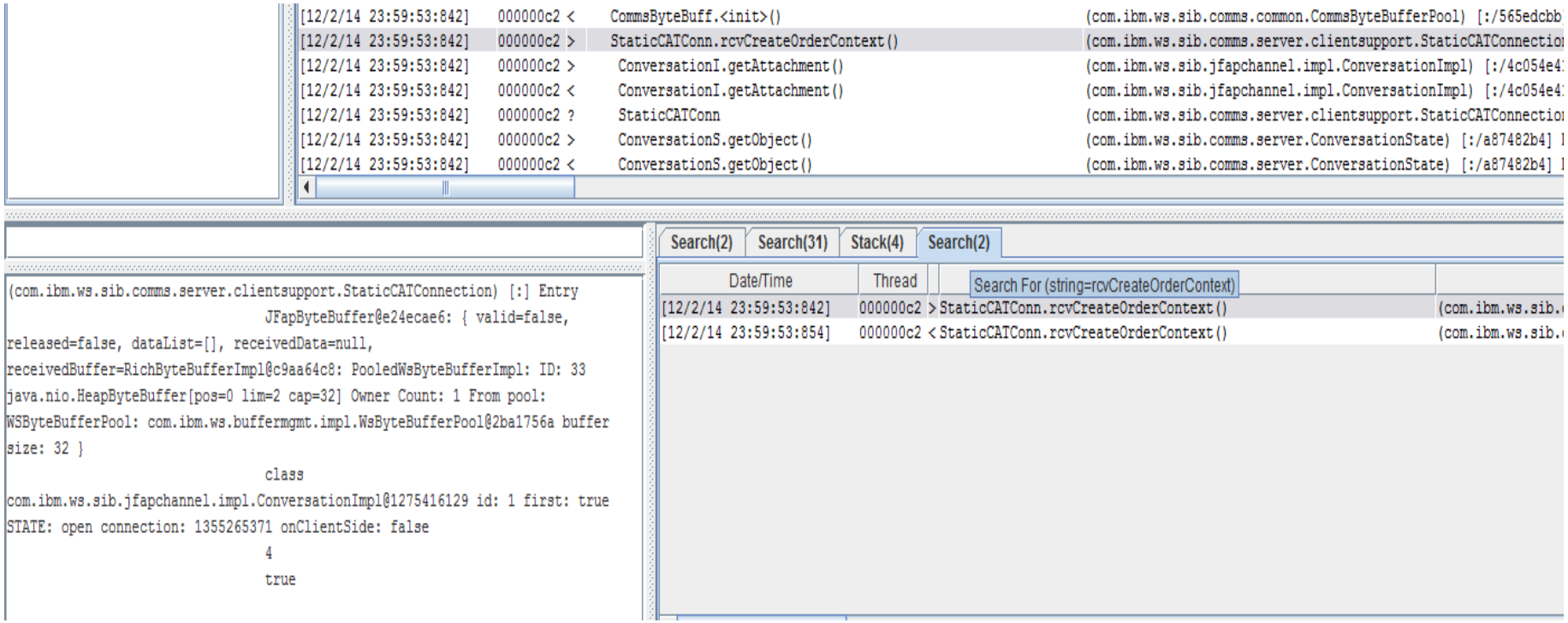
true

Java™

Trace Analyzer Search Engine



Trace Analyzer Search Engine - Cont



Tracking Request on ME Side

- The {JFAPSUMMARY} information on the client side can be used for tracking purposes on the ME side:
  - Example: Tracking a producer request:

    “9.65.164.108:60491:9.65.164.108:7276:1:5”
  - Or the whole conversation:

    “9.65.164.108:60491:9.65.164.108:7276:1”

Tracking Request on ME Side - Cont

- Searching for “9.65.164.108:60491:9.65.164.108:7276:1:5” (obtained from client side), we get 2 hits:
  - JFapchannel side receiving the create producer session command:

    [12/2/14 23:59:53:954] **000000bf** JFapUtils [(com.ibm.ws.sib.jfapchannel.impl.JFapUtils) [:] {JFAPSUMMARY}[**9.65.164.108:60491:9.65.164.108:7276:1:5**] 50c7b55b[CLIENT-ME IN 9.65.164.108:7276<-9.65.164.108:60491, closeDeferred=false, invalidateDeferred=false]:4c054e41[ConvId:1] **received** conversation data with segment 48 (**SEG_CREATE_PRODUCER_SESS**)]

  - and that gets dispatched to another thread (000000c2).

    [12/2/14 23:59:53:968] **000000c2** JFapUtils [(com.ibm.ws.sib.jfapchannel.impl.JFapUtils) [:] {JFAPSUMMARY}[9.65.164.108:60491:9.65.164.108:7276:1:5] 50c7b55b[CLIENT-ME IN 9.65.164.108:7276<-9.65.164.108:60491, closeDeferred=false, invalidateDeferred=false]:4c054e41[ConvId:1] **Send** [Request Id:5] c8 (SEG_CREATE_PRODUCER_SESS**_R**)]

...

What is a “Local” ME?

- If the client application connects to a “local” ME, expect to see JMS and RA calls instead of Jfap, until this very call called 'createProducerSession()'.
- The ME is considered local to the client application if the latter is deployed in the same server when that ME runs.

ME Communications (SIB Comms)

- The ME comms trace group (SIBCommunications=all) should allow you to see your destination being resolved:

```
[12/2/14 23:59:53:964] 000000c2 CommsByteBuff
(com.ibm.ws.sib.comms.common.CommsByteBuffer) [:] Destination name:
                        Qnaj01
[12/2/14 23:59:53:964] 000000c2 CommsByteBuff.getSIDestinationAddress()
[(com.ibm.ws.sib.comms.common.CommsByteBuffer) [:/3a569d4a] Exit]
[12/2/14 23:59:54:215] 000000c2 StaticCATProd
[(com.ibm.ws.sib.comms.server.clientsupport.StaticCATProducer) [:] Destination: [ QNaj01, false, null,
null ]]...
```

- CommsByteBuff call extends a JFap particular method to allow many useful methods that Comms requires for putting data into buffers for transmission or reception. It can also be used to put / get Strings, XId's, transaction information, messages of all kinds, destination addresses and selection criterias ...ect.
- StaticCATProducer class takes responsibility for dealing with all FAP flows relating to message producers.

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Tracing Messages

- We will now review the following:
- Messages going to a local ME
- Messages going to a remote ME
- Messages going through a bridge
- Identifying a specific message

Tracing Messages

- Publish/Subscribe Test Environment
- JVMs: PubSubServer1 (PS1), PubSubServer2 (PS2), PubSubServer3 (PS3)
- The topic destination is: JMSMonitorTopicSpace
- PS1 and PS2 are on a different bus than PS3
- The PubSub test application used for this presentation publishes a message on PS1, and the subscriber application prints a message in SystemOut.log on PS3
- Trace string:
  SIBCommunications=all:SIBMessageTrace=all:SIBProcessor=all

Tracing Messages

- When a message is put to a local destination several UserTrace messages are generated
- One or more of those messages will have a system message ID (SysMsgId)
- A SysMsgId can be used to track a message throughout a SIB network
- Sample SysMsgId: 395540756E349BC6_34500004

Tracing - Messages

- **Test results**

Important messages on PS1

(com.ibm.ws.sib.processor.utils.UserTrace) [:] **CWSJU0021**I: A message with ID ID:855e785fd2e9a48ed3a0ec59110a134f0000000000000001 **system message ID 395540756E349BC6_34500004** and correlation ID null is transmitting to messaging engine with ID RAMANDUNode_01.**PubSubServer2**-GEMS for destination **JMSMonitorTopicSpace**

(com.ibm.ws.sib.processor.impl.**PubSubOutputHandler**) [:] Entry MessageItem@d594765c[395540756E349BC6_34500004,ID:855e785fd2e9a48ed3a0ec59110a134f0000000000000001,69000017,'**My message ==> 1**']

Tracing - Messages

Important messages on PS2:

com.ibm.ws.sib.processor.utils.UserTrace) [:] CWSJU0020I: A message with ID ID:855e785fd2e9a48ed3a0ec59110a134f0000000000000001 system message ID **395540756E349BC6_34500004** and correlation ID null **was received** from the messaging engine with ID 395540756E349BC6 with a destination **JMSMonitorTopicSpace**

(com.ibm.ws.sib.processor.impl.**PubSubOutputHandler**) [:] Entry MessageItem@f8733b89[395540756E349BC6_34500004,ID:855e785fd2e9a48ed3a0ec59110a134f0000000000000001,-1,'**My message ==> 1**'

Tracing - Messages

Important messages on PS3

12/3/14 19:36:46:578 MST 0000008f I SibMessage [:]
CWSIV0777I: A connection to messaging engine
RAMANDUNode_01.**PubSubServer2**-GEMS for destination
JMSMonitorTopicSpace on bus GEMS has been successfully created.

12/3/14 19:39:33:194 MST 000000c7 < CommsByteBuff.getMessage
(com.ibm.ws.sib.comms.common.CommsByteBuffer) [:] Exit
com.ibm.ws.sib.mfp.impl.JsJmsTextMessageImpl@76ee7d8a{**SysMsgId=3955407
56E349BC6_34500004**}

12/3/14 19:39:33:404 MST 000000cf SystemOut
CONSUMED MESSAGE ==> **My message ==> 1**

Agenda

- Service Integration Bus: A quick overview
- Tools used for diagnostic data collection and analysis:
  - IBM Support Assistant for Data Collection (ISADC)
  - WAS Trace Analyzer
- Preparation for WAS Tracing
- SIB Trace Strings
- Tracing JFAP Channel and SIB Communications
- Tracing Messages
- Tracing SIB Database Interaction

Tracing – Message Stores

- Every ME has a message store
- A message store can be either a data store, which uses a commercial database product such as DB2, or a file store which uses three flat files
- The default is to use a file store

Tracing – Message Stores

Data Stores

- SIB uses SQL when working with a database
- Use **SIBMessageStore=all** to capture the SQL statements in a trace

Tracing – Message Stores

File Stores

- Use this trace string: SIBMessageTrace=all
- Watch for UserTrace messages:

(com.ibm.ws.sib.processor.utils.UserTrace) [:] CWSJU0004I: A message with ID ID:414d5120514d303120202020202020205f7280542000be02, system message ID D4ACA879059BD2C5_2000003 and correlation ID null is **put to queue MQ.GATEWAY.OM.IN**

(com.ibm.ws.sib.processor.utils.UserTrace) [:/4015a55b] CWSJU0003I: A message with ID ID:414d5120514d303120202020202020205f7280542000be02, system message ID D4ACA879059BD2C5_2000003 and correlation ID null is **committed to destination MQ.GATEWAY.OM.IN**, which is targetted for messaging engine RAMANDUNode_01.OMSERVER-BUS1.

Summary

- We have discussed the basics of tracing SIB communications, messaging and message stores
- We have introduced the Trace Analyzer
- The skills acquired today apply to other components of WebSphere Application Server, the major difference being the trace strings used
- These skills will make you less dependent on IBM and give you more flexibility in managing your Websphere installation

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Questions and Answers

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- View a webcast replay with step-by-step instructions for using the Service Request (SR) tool for submitting problems electronically:
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