

Introducing the IBM Support Assistant (ISA) for WebSphere on z/OS

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Share 115 – Boston, August, 2010



Outline: *ISA Tools for WebSphere on z/OS*

Garbage Collection analysis:

- GC and Memory Visualizer (GCMV) **
- Pattern Modeling Tool for Java GC (PMAT)

Dump analysis:

- Memory Analyzer (MAT) **
- Dump Analyzer **
- HeapAnalyzer
- Memory Dump Diagnostic for Java (MDD4J)
- Thread & Monitor Dump Analyzer for Java (TMDA)



Trace analysis:

- Trace and Request Analyzer for WAS
- Log Analyzer

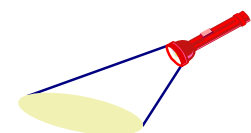
Real-time analysis: Health Center **

Configuration analysis: Visual Configuration Explorer (VCE)

** "IBM Monitoring and Diagnostic Tools for Java™"

Appendix

- Installing the IBM Support Assistant
- Other Diagnostic Tools for WebSphere on z/OS
- Working with Dumps & Traces
- Testing Tools & Sample Applications
- Documentation, Help & Web Resources



Diagnostic Data from WAS on z/OS

TSO/SDSF

- Browse logs
- MVS Modify cmds
- Turn tracing on
- Display WAS Serv

Other TSO/ISPF Apps

- RMF Monitors
- IPCS
- DB2 Admin

Telnet Client

- View logs
- UNIX commands
- FTP

Java tools

- Jextract, . . .

Web Browsers

- ISC - TPV
- z/OSMF Inc.Log M

ISA Tools

- Health Center
- GC analyzers
- Dump analyzer:
- Log Analyzers
- VCE



Workstation

3270/TSQ

- SDSF/MVS console
- RMF - SMF

Telnet

- vi
- Wsadmin

Browser

- ISC (TPV)

ISA

- Analyzers
- VCE
- Health Center



How many ways can we analyze WAS on z/OS?



z/OS

Comm Server

- TN3270
- TCP/IP

- INETD

- FTP Server

- WAS

- Server

- PMI-TPV

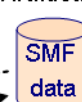
- Health Center

- Servant Region JVM

- WAS/OEM

- zOSMF

Artifacts



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Which Tools for which Artifacts?

Artifact	Tool
GCverbose xml (SYSOUT)	GCMV PMAT
Javacore	TMDA
Heapdump	Memory Analyzer MDD4J HeapAnalyzer
System Dump (jextracted)	Memory Analyzer Dump Analyzer
Logs & Traces	TRA Log Analyzer
Real Time Running Server	Health Center
Configuration XML files	VCE

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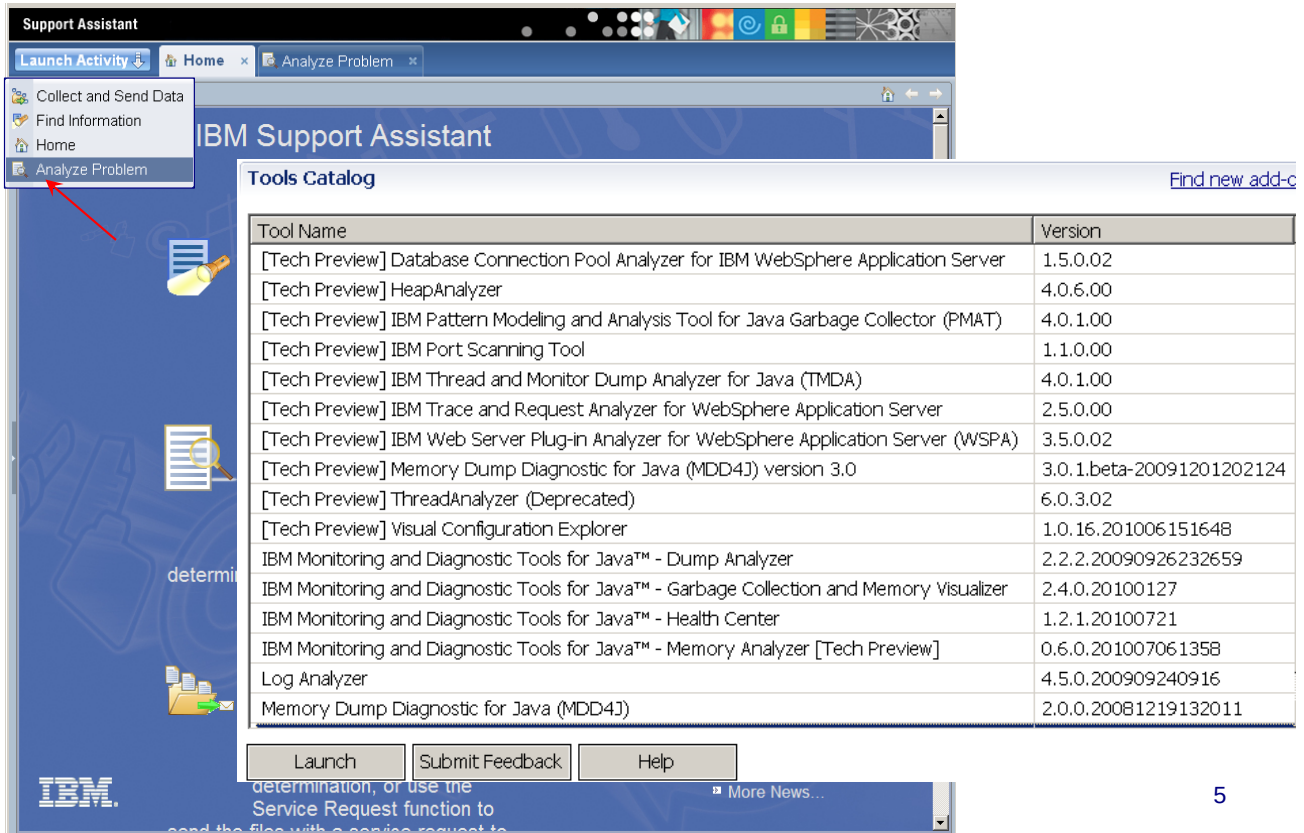
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IBM Support Assistant (ISA) - Launch pad:

Use “Launch Activity” pull-down > “Analyze Problem”



Tool Name	Version
[Tech Preview] Database Connection Pool Analyzer for IBM WebSphere Application Server	1.5.0.02
[Tech Preview] HeapAnalyzer	4.0.6.00
[Tech Preview] IBM Pattern Modeling and Analysis Tool for Java Garbage Collector (PMAT)	4.0.1.00
[Tech Preview] IBM Port Scanning Tool	1.1.0.00
[Tech Preview] IBM Thread and Monitor Dump Analyzer for Java (TMDA)	4.0.1.00
[Tech Preview] IBM Trace and Request Analyzer for WebSphere Application Server	2.5.0.00
[Tech Preview] IBM Web Server Plug-in Analyzer for WebSphere Application Server (WSPA)	3.5.0.02
[Tech Preview] Memory Dump Diagnostic for Java (MDD4J) version 3.0	3.0.1.beta-20091201202124
[Tech Preview] ThreadAnalyzer (Deprecated)	6.0.3.02
[Tech Preview] Visual Configuration Explorer	1.0.16.201006151648
IBM Monitoring and Diagnostic Tools for Java™ - Dump Analyzer	2.2.2.20090926232659
IBM Monitoring and Diagnostic Tools for Java™ - Garbage Collection and Memory Visualizer	2.4.0.20100127
IBM Monitoring and Diagnostic Tools for Java™ - Health Center	1.2.1.20100721
IBM Monitoring and Diagnostic Tools for Java™ - Memory Analyzer [Tech Preview]	0.6.0.201007061358
Log Analyzer	4.5.0.200909240916
Memory Dump Diagnostic for Java (MDD4J)	2.0.0.20081219132011

Launch Submit Feedback Help

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GC Visualization and Analysis

```
<af type="tenured" id="13" timestamp="Jul 30 17:33:20 2009" intervals="1.601">
  <minimum requested_bytes="24" />
  <time exclusiveaccessms="0.132" meanexclusiveaccessms="0.063" threads="4" lastthreadid="0x43FA
  <refs soft="249" weak="11193" phantom="2" dynamicSoftReferenceThreshold="0" maxSoftReferenceThro
  <tenured freebytes="0" totalbytes="536870400" percent="0" >
    <soa freebytes="0" totalbytes="536870400" percent="0" />
    <loa freebytes="0" totalbytes="0" percent="0" />
  </tenured>
```

1. Enable verbose GC in your ISC:
 - AppServer -> Process defs -> Servant -> JVM, click on “Verbose garbage collection”.
 - Click “OK”, Save the changes, and re-start server.
2. Verify the verbose GC setting using SDSF
 - Look for <af> & <gc> xml structures in servant’s log.
3. Drive an application in your server.
 - Use your own, or sample apps provided.
 - Jmeter, MS Web AppStress tool or your own to drive load.
4. Copy verboseGC output from SYSOUT to ASCII file (on your workstation)
5. Launch GC verbose visualizers (GCMV or PMAT) and browse to the file you uploaded.

GC Tuning Suggestions

Do this before putting your applications into Production:

1. Install the application, test it.
2. Set JVM heap min/max size, & enable Verbose GC
3. Use a load driver to drive a representative, but constant load. (Consider using a “peak” load.)
4. Extract verbose GC statistics and study with a visualizer.
5. Under peak load, the time between GCs should be:
 - Constant, and about once every 10 seconds or more.
6. Look for Memory leaks – times between GC shorten.
7. Tune by experimenting independently with different heap sizes and GC policies.
8. To study the JVM contents, take a heap, core, or SDump, and use one of the Dump analysis tools.

(Don't forget to also analyze your applications with a profiler such as JinsightLive for System z.)

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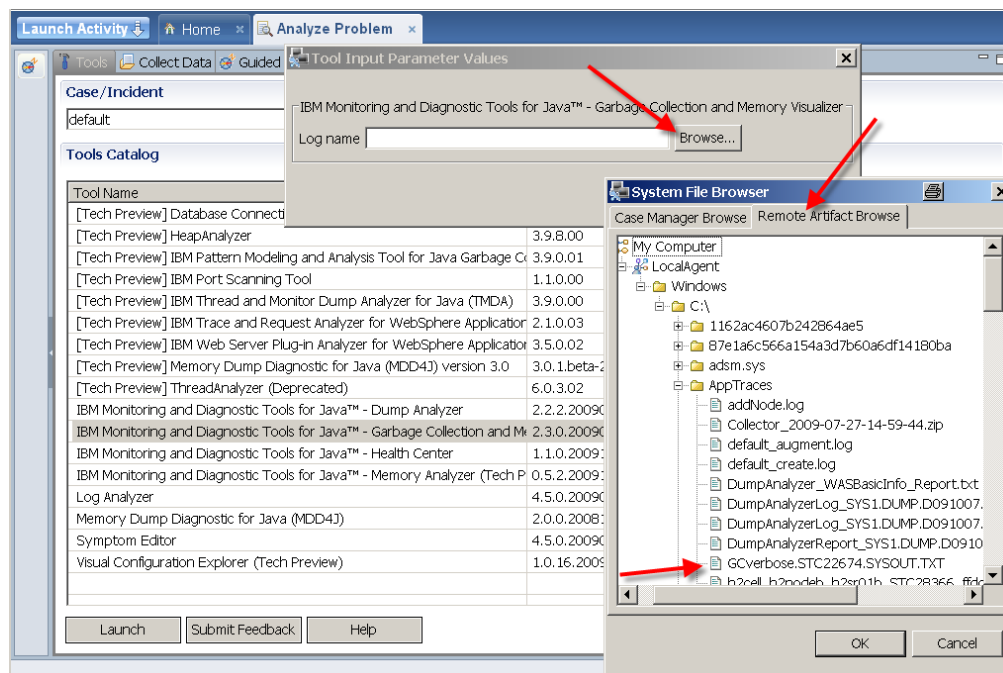
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GC Visualization and Analysis tools

Launch one of the GC verbose visualizers (GCMV or PMAT) and browse to the file you uploaded.



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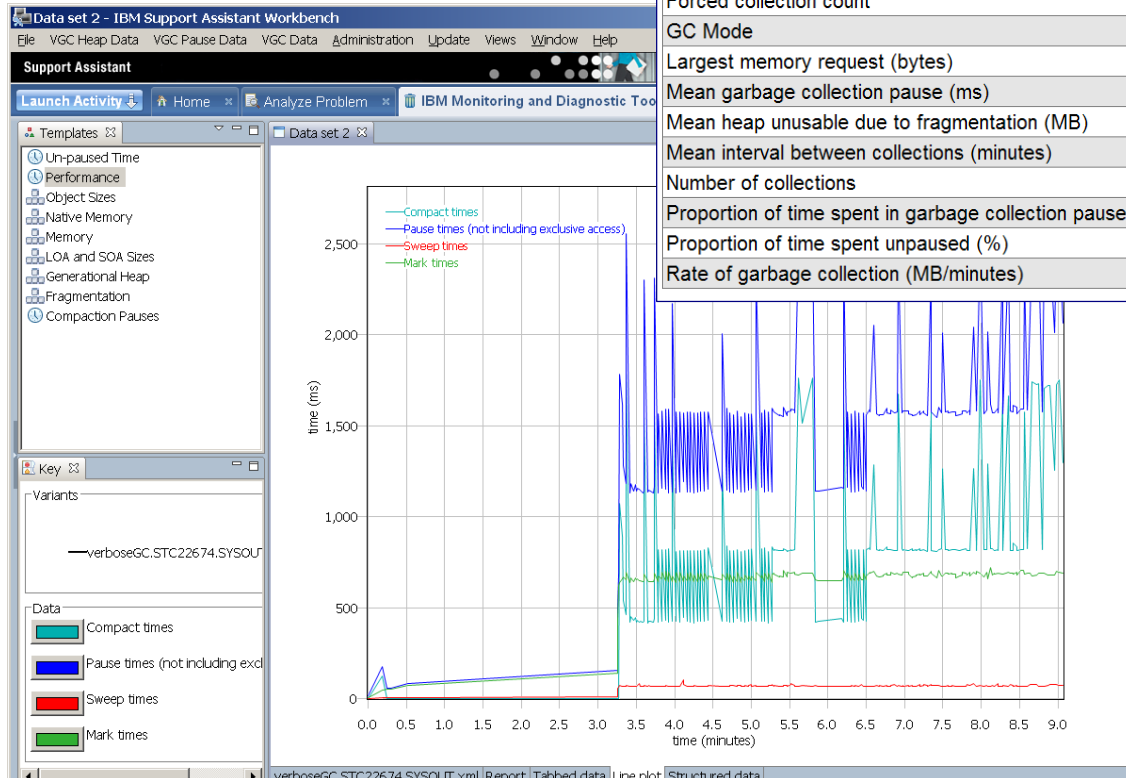
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GC and Memory Visualizer (GCMV) - IMDTJ



Uses verbose GC (xml doc)



Summary

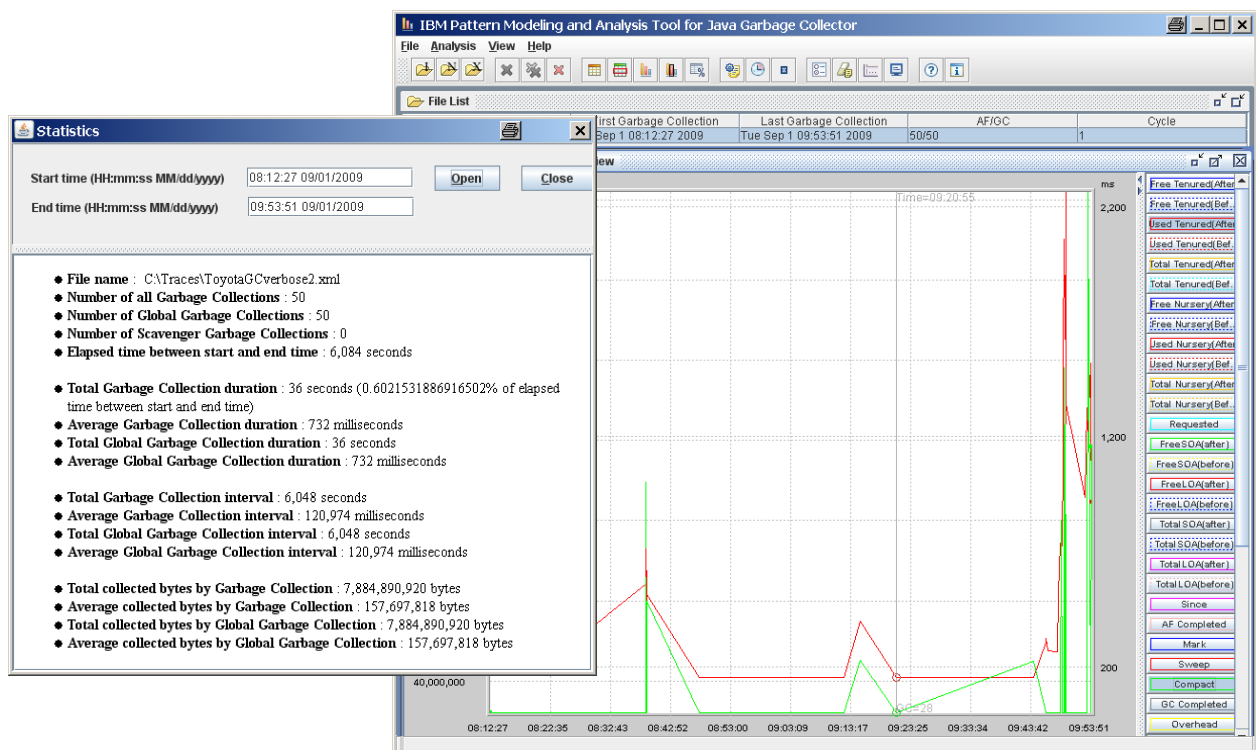
Allocation failure count	137
Forced collection count	3
GC Mode	optthruput
Largest memory request (bytes)	19496
Mean garbage collection pause (ms)	1514
Mean heap unusable due to fragmentation (MB)	0.0
Mean interval between collections (minutes)	0.04
Number of collections	209
Proportion of time spent in garbage collection pauses (%)	57.9
Proportion of time spent unpaused (%)	42.1
Rate of garbage collection (MB/minutes)	126

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Pattern Modeling & Analysis Tool for Java GC (PMAT)



Different perspective than GCMV - PMAT does not run in the ISA workspace. When you click Next, a separate display appears.



JVM Dumps - Many kinds . . .

- **Java Dumps** > /var/home/...
 - Heap
 - JavaCore
 - JVM TDUMP:
- SVC Dumps, ABEND Dumps, SYSABENDs
- CEE Dumps

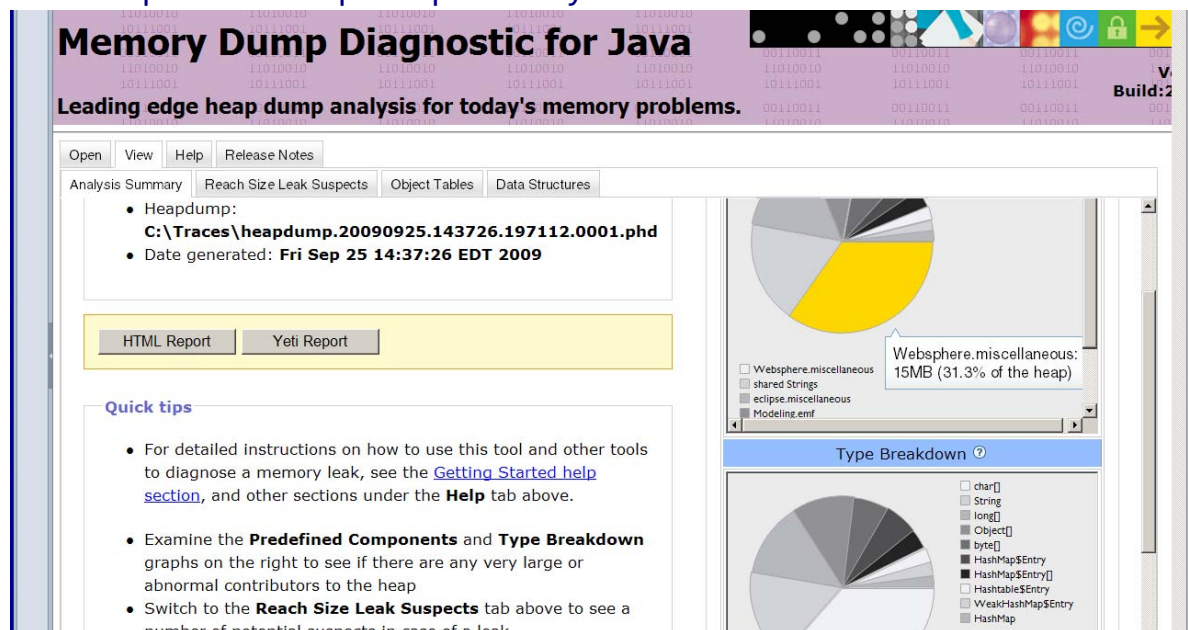
Analysis Tools:

- MDD4J – high level – good for “Leak Suspects”
- Memory Analyzer – More detailed
- Dump Analyzer
- Heap Analyzer
- Thread & Monitor Dump Analyzer for Java (TMDA)

See “Analyzing Dumps” in appendix for more details.

Memory Dump Diagnostic for Java - V3 (MDD4J)

- **Focus on data structures that may cause memory related problems.**
- **Analyze heap dumps:**
 - “Baseline” heap dump – take when application is started.
 - “Primary” heap dump – when a problem occurs.
 - “Comparative” heap dumps – analyze differences.



MDD4J analysis (cont'd)



- **Guided Activity Assistant**

- “Summary” – Basic Heap Info & Contents Summary.
- “Reach Size Leak Objects” – Cumulative size of all objects.
- “Object/Class” leak suspects.
- “Data Structures view” – Understand relations & Track Changes.
 - Big/Growing/Shrinking/Steady

- **Yeti Reports:** (HTML or Yeti zip file)

- Save as HTML file, or Yeti analysis zip file – extract & open `index.html` file.
- Analysis engine based on “Yeti” technology.
 - Overview
 - Health Report
 - Content Graphs – Type & Field layout views

- **Additional documentation:**

- Techdoc WP101612 – “Getting started with GC, Heapdumps and Javacores for WebSphere on z/OS”
- DeveloperWorks Summary doc:
www.ibm.com/developerworks/websphere/techjournal/0909_supauth/0909_supauth.html

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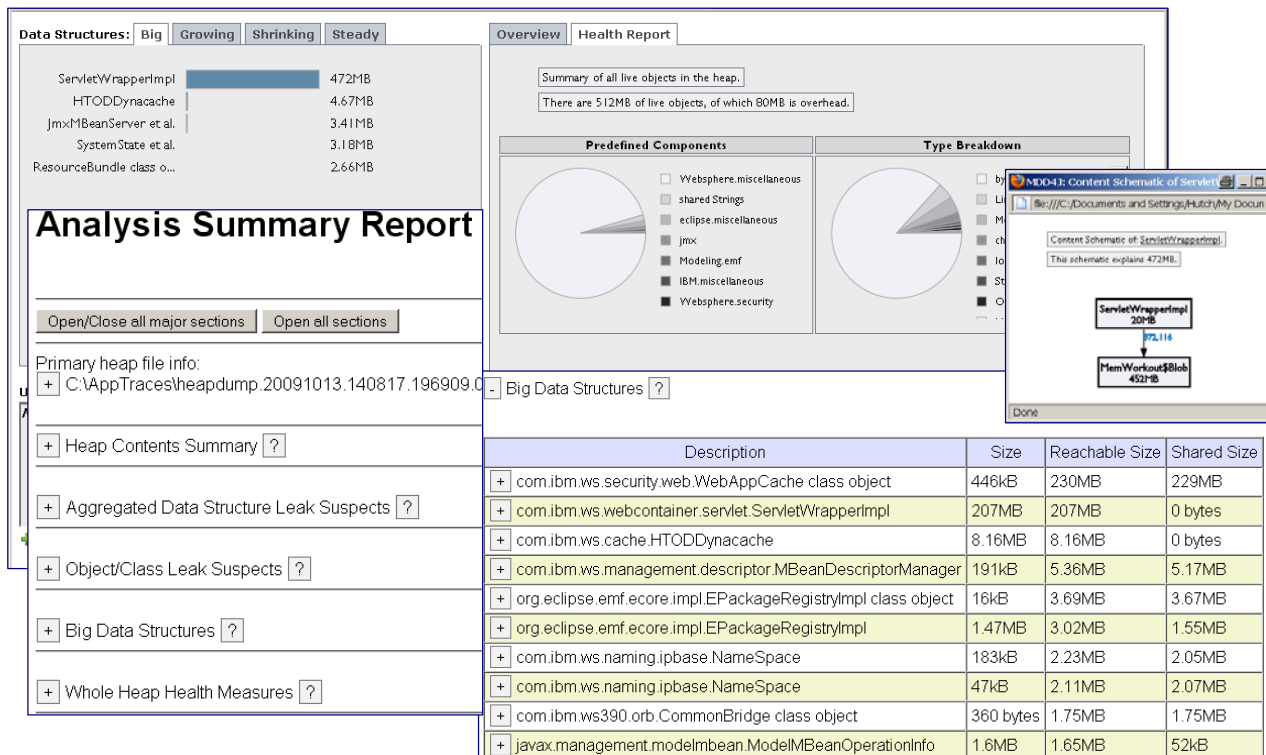
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Yeti Reports (from MDD4J)



Extract zip file created by MDD4J, & launch `index.html`



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Memory Analyzer (IMDTJ)



- Based on open source M.A.T. + DTFJ - www.eclipse.org/mat
- For java heapdumps, System Dumps (jextracted) & javacore*

Getting Started wizard:

- Overview ----->
- Leak report
- Component reports

Navigate: (TOC, Fly-over, Click)

- Histogram (tables)
- Context (In, Out Refs)
- Group (Pkg, Class, Loader)
- Dominator Tree
 - Objects keeping others
- Path to GC roots
- Leak reports



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Memory Analyzer samples



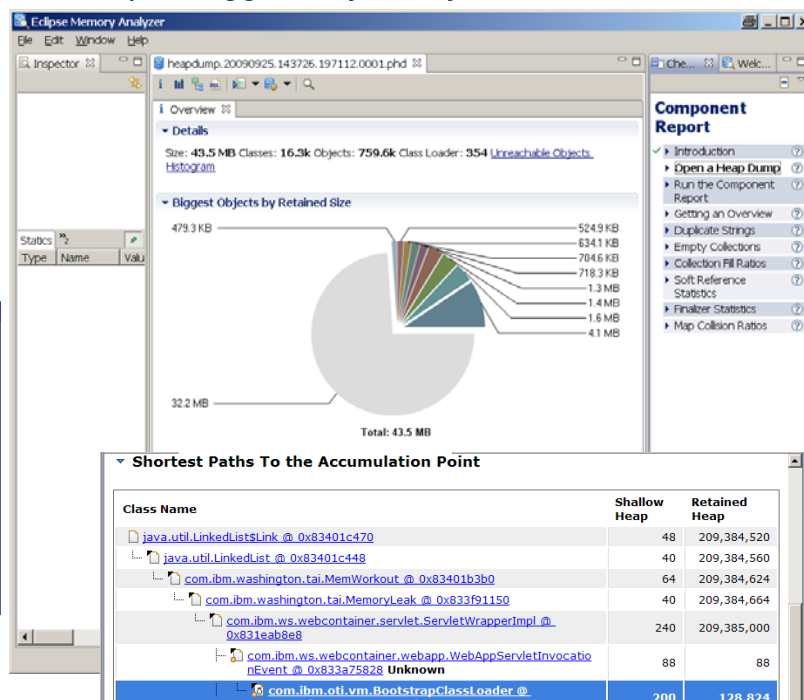
Navigate: (TOC, Fly-over, Click)

- Histogram (tables)
- Context (In, Out Refs)
- Group (Pkg, Class, Loader)
- Dominator Tree
 - Objects keeping others
- Path to GC roots
- Leak reports

Example: Biggest objects by Retained Size:

Table Of Contents

- System Overview
 - Heap Dump Overview
 - System Properties
 - Thread Overview
 - Top Consumers
 - Biggest Objects (Overview)
 - Biggest Objects
 - Biggest Top-Level Dominator Classes (Overview)
 - Biggest Top-Level Dominator Classes
 - Biggest Top-Level Dominator Class Loaders (Overview)
 - Biggest Top-Level Dominator Class Loaders
 - Biggest Top-Level Dominator Packages
 - Class Histogram
- Leaks
 - Overview
 - Problem Suspect 1
 - Description



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Memory Analyzer sample use case



- File>Open Heap Dump > Leak Suspects Report > Problem Suspect1 > “Shortest Paths To the Accumulation Point” and “Accumulated Objects”
- There we found the suspect “MemoryLeak.”

Shortest Paths To the Accumulation Point

Class Name	Shallow Heap	Retained Heap
java.util.LinkedList@ 0x83401c470	48	209,384,520
java.util.LinkedList @ 0x83401c448	40	209,384,560
com.ibm.washington.tai.MemWorkout @ 0x83401b3b0	64	209,384,624
com.ibm.washington.tai.MemoryLeak @ 0x833f91150	40	209,384,664
com.ibm.ws.webcontainer.servlet.ServletWrapperImpl @ 0x831eab8e8	240	209,385,000
com.ibm.ws.webcontainer.webapp.WebAppServletInvocationEvent @ 0x833a75828 Unknown	88	88
com.ibm.oti.vm.BootstrapClassLoader @ 0x827f42910 System Class	200	128,824
java.util.LinkedList@ 0x833a6d880	48	48
com.ibm.ws.util.CauseNode @ 0x831ec8590	56	432
Total: 3 entries		

Accumulated Objects

Class Name	Shallow Heap	Retained Heap	Percentage
com.ibm.ws.webcontainer.servlet.ServletWrapperImpl @ 0x831eab8e8	240	209,385,000	77.79%
com.ibm.washington.tai.MemoryLeak @ 0x833f91150	40	209,384,664	77.79%
com.ibm.washington.tai.MemWorkout @ 0x83401b3b0	64	209,384,624	77.79%
java.util.LinkedList @ 0x83401c448	40	209,384,560	77.79%

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Dump Analyzer - IMDTJ



- Based on JVM's `jdumpview` tool
- System dumps processed by jextract
- FTP to workstation (binary)
- Import dump – “Browse”
- Select report, “Analyze”
 - Click on WASBasicInfo . . . or . . .

2.1.2. Summary Information

Deployed applications and modules (see section below for more details):

- Number of deployed Enterprise Applications: 14
- Number of deployed Enterprise Applications not started: 0
- Number of deployed WAR modules: 13
- Number of deployed WAR modules not started: 0
- Number of deployed EJB modules: 5
- Number of deployed EJB modules not started: 0

Threads and thread pools (see section below for more details):

- Number of deadlocks detected: 0
- Total number of Java threads (in pools and not in pools): 52
- Number of Java threads not in a WAS thread pool: 35
- Number of native threads not associated with a Java thread: 4
- Number of WAS thread pools: 23
- Number of pool threads currently active: 1
- Number of pool threads currently allocated: 17
- Number of pool threads allowed before exceeding maximum configured pool sizes: 711
- Number of threads currently in pools that are at over 90% of the maximum pool size: 1
- Number of threads currently in pools that are at over 100% of the maximum pool size: 1
- Number of threads currently in pools that are at over 150% the maximum pool size: 0
- Current hung thread detection threshold (msec): 600000
- Current number of threads suspected of being "hung": 0

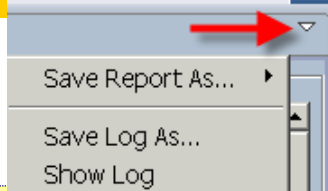
Upper-right corner of screen

- Save Report as...
 - HTML, XML, txt
- Save Log as...
 - Save Log as ...18

Dump Analyzer – Analysis Reports

- Save Report As: html, xml, or txt files

- Default Dump Report:



2. Analysis results
DumpAnalyzer V:2.2.2.20090926232659 : Start analysis of C:\AppTraces\SYS1.DUMP.D091014.zip

2.1. Results from Analyzer=com.ibm.dtfj.analyzer.jvm.DefaultDumpReport_Standard
Analyzer full name: com.ibm.dtfj.analyzer.jvm.DefaultDumpReport_Standard
Analyzer version: 1.3.0.20070812
Analyzer description: Report basic information from this JVM image (similar to javacore) - Standard version

2.1.1. Image and runtime information
Now reporting on runtime: 0.0.0
Image: (no identity)
Time of dump: Wed Oct 14 02:28:14 EDT 2009
System Type: z/OS System SubType: 01.10.00
Processor Type: s390x Processor SubType:
Number of Processors: 2
Installed Memory: 6442450944
Host Name: wsc2
IP address: /9.82.24.70
This Image contains: 1 address spaces; 1 processes; 1 runtimes

Process: PID:0x30208
Executable: main
Command line: [<null>]
Pointer size (bits): 64
Signal that triggered this dump: 0 ((no signal info available, or dump was not triggered by a signal))
Current Thread: 0x14b06000

Java Runtime: JavaVM@0x000000080B178548
Java Version: Java(TM) SE Runtime Environment(build pmz6460sr5ifx-20090623_02 (SR5)) IBM J9

2.1.2. JVM Initialization Arguments
JNI ignoreUnrecognized: False
JNI version: 65540
-Xthr:tw=HEAVY ExtraInfo=0x00000000

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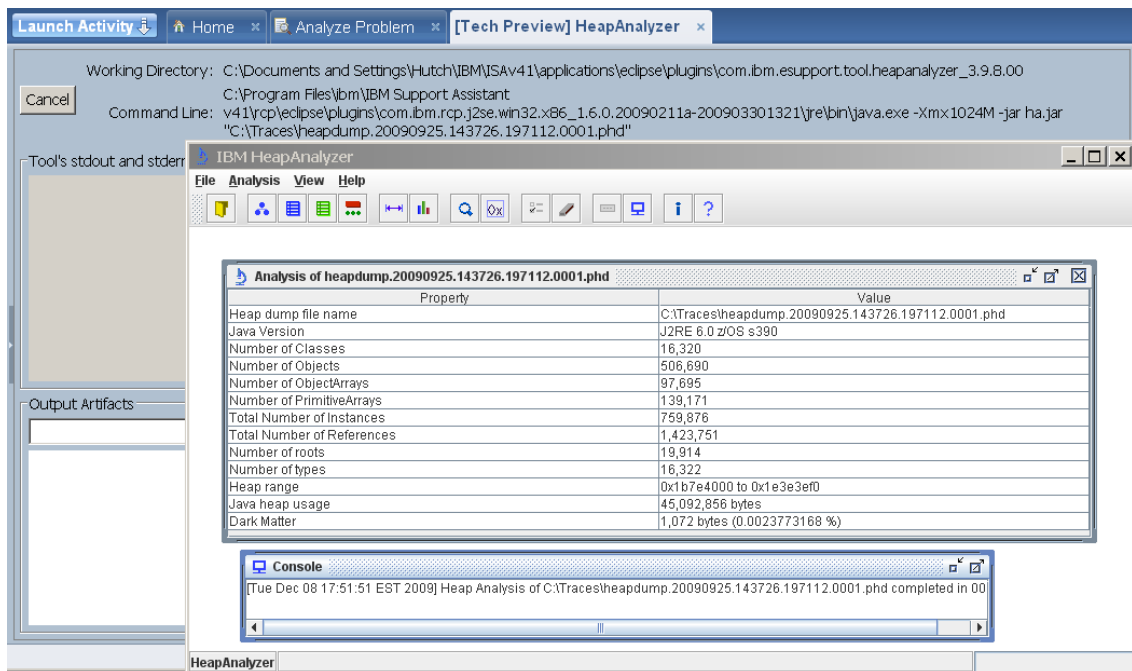
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HeapAnalyzer (New on ISA!)

- Originally provided on AlphaWorks
- Graphical analysis of javacores (heapdumps)
- Creates tables & graphs
- Heuristic engine to find memory leaks and excessive heap usage.



Working Directory: C:\Documents and Settings\Hutch\IBM\SAV41\applications\ eclipse\plugins\com.ibm.esupport.tool.heapanalyzer_3.9.8.00
Command Line: C:\Program Files\IBM\IBM Support Assistant
v41\rcp\ eclipse\plugins\com.ibm.rcp.j2se.win32.x86_1.6.0.20090211a-200903301321\jre\bin\java.exe -Xmx1024M -jar ha.jar "C:\Traces\heapdump.20090925.143726.197112.0001.phd"

IBM HeapAnalyzer

Property	Value
Heap dump file name	C:\Traces\heapdump.20090925.143726.197112.0001.phd
Java Version	J2RE 6.0 z/OS s390
Number of Classes	16,320
Number of Objects	506,690
Number of ObjectArrays	97,695
Number of PrimitiveArrays	139,171
Total Number of Instances	759,876
Total Number of References	1,423,751
Number of roots	19,914
Number of types	16,322
Heap range	0x1b7e4000 to 0x1e3e3ef0
Java heap usage	45,092,856 bytes
Dark Matter	1,072 bytes (0.0023773168 %)

Console
[Tue Dec 08 17:51:51 EST 2009] Heap Analysis of C:\Traces\heapdump.20090925.143726.197112.0001.phd completed in 00

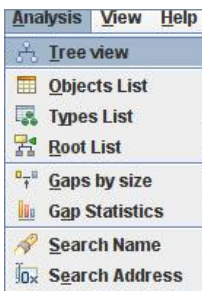
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HeapAnalyzer (cont'd)



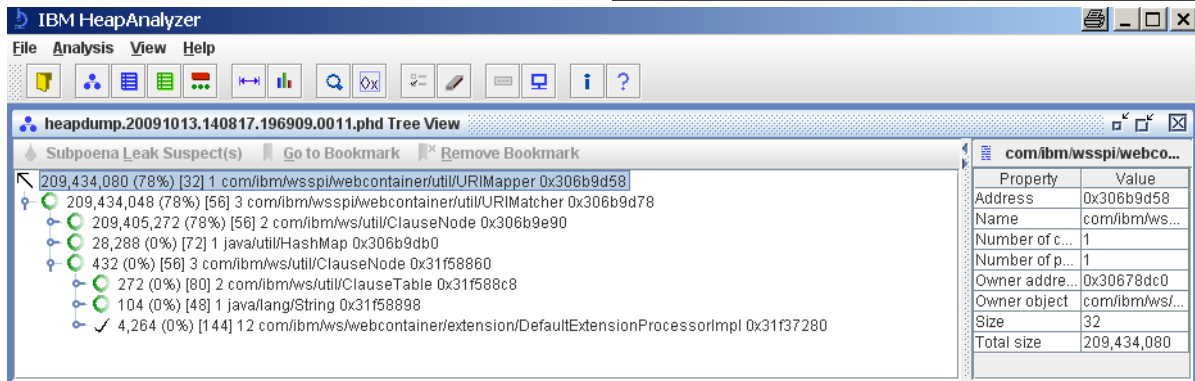
• Analysis Views:

- Tree view
- Objects List
- Types List
- Root List
- Gaps by size

Locate a leak suspect



Located a leak suspect
java/util/LinkedList\$Link (count : 340,599)
is responsible for 209,383,848 bytes



See detailed information of a node; search for total size drop between parent and child.

- Tree node format: **TotalSize(Size/Heap%) [ObjSize] #ChildObj (# root obj) Name Addr**
- Select a node and right click to find an address.

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Thread & Monitor Dump Analyzer for Java (TMDA)



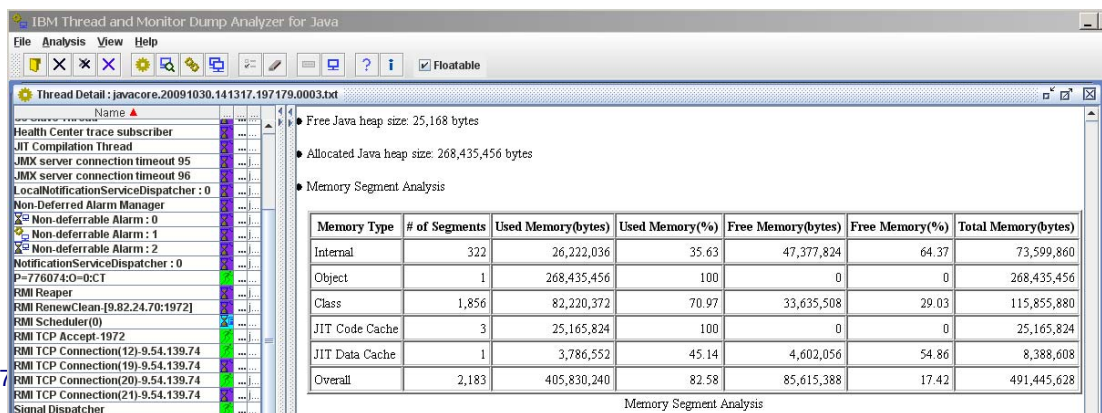
TMDA for Java analyzes javacore dumps and helps you find hangs, deadlocks, resource contention, and bottlenecks in Java threads. (Tech preview.)

Webcast & Foils: ibm.com/support/docview.wss?uid=swg27011855

Features provided & Color coding:

- Summary of Javacore
- Thread detail view
- Monitor detail view
- List of hang suspects
- Thread compare view
- Thread comparison summary
- Monitor lock compare view
- Garbage collector statistics for IBM JVM

Status	Number of Threads : 59	Percentage
Deadlock	0	0 (%)
Runnable	16	27 (%)
Waiting on condition	39	66 (%)
Waiting on monitor	0	0 (%)
Suspended	0	0 (%)
Object wait()	0	0 (%)
Blocked	3	5 (%)
Parked	1	2 (%)



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Working with Traces from WAS on z/OS



- **STDOUT & STDERR** traces usually go to JES logs
 - Keep them off SYSLOG by specifying separate DD files
 - May be re-directed to HFS files – TD103695
 - Not suited for ISA trace analysis tools
- **java tracing** - enable dynamically:
 - Modify (F) MVS commands:
 - F server,tracejava='com.ibm.*=all'
 - F server,tracedetail=(3,4)
 - F server, TRACEINIT
- **ffdc** logs – automatically generated
- **wsadmin.sh** tracing – modify **wsadmin.properties** file
- **JDBC** tracing – **db2.jcc.override.traceFile=** in **DB2JccConfiguration.properties** file

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TRA - Trace and Request Analyzer for WAS



- Here's a Gap Analysis for the addNode.log:
(Works with trace files from wsadmin logs.)

IBM Trace and Request Analyzer for WebSphere Application Server				File Analysis Customized Analysis View Help	
Trace Gap Analysis				Trace	
Time(...)	Trace	Line Num...	Fi...		
72,494	[9/8/08 15:12:38:376 EDT] 00000000 AdminTool A BBOO0222I: ADMU0022I: Node Agent launched. Waiting for initialization status.	107	a...		
	[9/8/08 15:13:50:870 EDT] 00000000 AdminTool A BBOO0222I: ADMU0030I: Node Agent initialization completed successfully. Process id is: 000002ac00000002	108	a...		
55,457	[9/8/08 15:11:12:337 EDT] 00000000 AdminTool A BBOO0222I: ADMU0120I: isclite on BLA will not be uploaded since it already exists in the target repository.	38	a...		
	[9/8/08 15:12:07:794 EDT] 00000000 AdminTool A BBOO0222I: ADMU0016I: Synchronizing configuration between node and cell.	39	a...		
29,879	[9/8/08 15:12:07:794 EDT] 00000000 AdminTool A BBOO0222I: ADMU0016I: Synchronizing configuration between node and cell.	39	a...		
	[9/8/08 15:12:37:673 EDT] 00000000 AdminTool A BBOO0222I: ADMU0018I: Launching Node Agent process for node: h2nodeb	105	a...		
29,249	[9/8/08 15:10:34:944 EDT] 00000000 AdminTool A BBOO0222I: ADMU0009I: Successfully connected to Deployment Manager Server: wsc2.washington.ibm.com:24010	21	a...		
	[9/8/08 15:11:04:193 EDT] 00000000 AdminTool A BBOO0222I: ADMU0050I: Servers found in configuration:	22	a...		
6,967	[9/8/08 15:12:27:595 EDT] 00000001 FileRepositor A BBOO0222I: ADMR0011I: Document cells/h2cell/PolicySets/WAS-I-RSP/policySet.xml is deleted.	102	a...		
	[9/8/08 15:12:34:562 EDT] 00000001 NodeSyncTask I com.ibm.ws.management.sync.NodeSyncTask doSync ADMS0003I: The configuration synchronization completed su...	103	a...		
4,920	[9/8/08 15:10:25:076 EDT] 00000000 ModelMgr I BBOO0222I: WSVR0801I: Initializing all server configuration models	19	a...		
	[9/8/08 15:10:29:996 EDT] 00000000 SSLConfigMana I BBOO0222I: CWPJK0027I: Disabling default hostname verification for HTTPS URL connections.	19	a...		
4,503	[9/8/08 15:10:29:996 EDT] 00000000 SSLConfigMana I BBOO0222I: CWPJK0027I: Disabling default hostname verification for HTTPS URL connections.	19	a...		
	[9/8/08 15:10:34:499 EDT] 00000000 AdminTool A BBOO0222I: ADMU0001I: Begin federation of node h2nodeb with Deployment Manager at wsc2.washington.ibm.com:...	20	a...		
3,266	[9/8/08 15:11:05:883 EDT] 00000000 AdminTool A BBOO0222I: ADMU0015I: Backing up the original cell repository.	27	a...		
	[9/8/08 15:11:09:149 EDT] 00000000 AdminTool A BBOO0222I: ADMU0012I: Creating Node Agent configuration for node: h2nodeb	28	a...		
1,279	[9/8/08 15:11:04:293 EDT] 00000000 AdminTool A BBOO0222I: ADMU0010I: Stopping all server processes for node h2nodeb	24	a...		
	[9/8/08 15:12:05:572 EDT] 00000000 AdminTool A BBOO0222I: ADMU0051I: Server h2sr01b cannot be reached. It appears to be stopped.	25	a...		
768	[9/8/08 15:11:10:527 EDT] 00000000 AdminTool A BBOO0222I: ADMU0014I: Adding node h2nodeb configuration to cell: h2cell	32	a...		
	[9/8/08 15:11:11:295 EDT] 00000000 AdminTool A BBOO0222I: ADMU0012I: WebSphereWSDM on CU will not be uploaded since it already exists in the target repository.	33	a...		
693	[9/8/08 15:11:09:149 EDT] 00000000 AdminTool A BBOO0222I: ADMU0012I: Creating Node Agent configuration for node: h2nodeb	28	a...		
	[9/8/08 15:11:09:842 EDT] 00000000 AdminTool A BBOO0222I: ADMU0012I: WebSphereWSDM.ear will not be uploaded since it already exists in the target repository.	29	a...		
686	[9/8/08 15:12:21:688 EDT] 00000001 FileRepositor W BBOO0222I: ADMR0011W: The system is overwriting document cells/h2cell/variables.xml by request.	48	a...		
	[9/8/08 15:12:22:374 EDT] 00000001 FileRepositor A BBOO0222I: ADMR0010I: Document cells/h2cell/variables.xml is modified.	49	a...		
669	[9/8/08 15:12:37:707 EDT] 00000000 AdminTool A BBOO0222I: ADMU0020I: Reading configuration for Node Agent process: nodeagent	106	a...		
	[9/8/08 15:12:38:376 EDT] 00000000 AdminTool A BBOO0222I: ADMU0022I: Node Agent launched. Waiting for initialization status.	107	a...		
575	[9/8/08 15:12:25:886 EDT] 00000001 FileRepositor A BBOO0222I: ADMR0010I: Document cells/h2cell/cus/libmasyncrsp/cver/BASE/cu.xml is modified.	88	a...		
	[9/8/08 15:12:26:461 EDT] 00000001 FileRepositor A BBOO0222I: ADMR0009I: Document cells/h2cell/PolicySets/WAS-I-RSP ND/policySet.xml is created.	89	a...		

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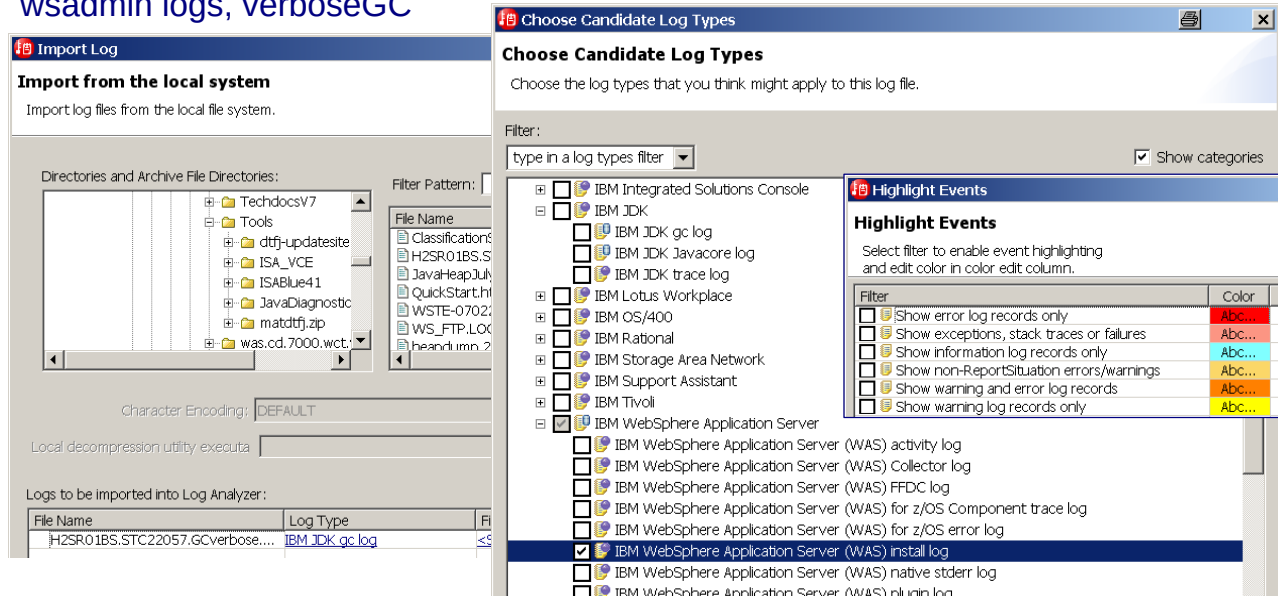
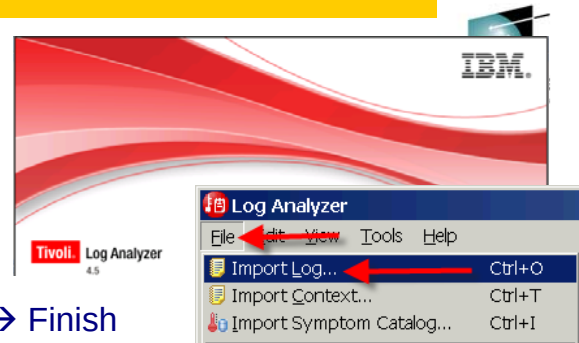
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Log Analyzer – Importing Logs

Tivoli Log Analyzer opens in a new window
Click on File → Import Log from local system

Select log file → Symptom Catalog (WAS V.7) → Finish
wsadmin logs, verboseGC



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Health Center:

Real-time Monitor with low overhead



- **YouTube videos**
 1. **Overview of Health Center features**
www.youtube.com/watch?v=5Tcktcl0qxs
 2. **Install IBM Support Assistant and Health Center**
www.youtube.com/watch?v=6WjE9U0jvEk
 3. **How to enable a Java application for live monitoring by the Health Center**
www.youtube.com/watch?v=Hdp0mJ13NLQ
- **Enabling a server (very easy!):**
 - Add **-Xhealthcenter** to servant JVM properties
- **Updating the healthcenter.jar file**
 - Download, unpx & copy the z/OS agent pkg (**mz64.pax**) from ISA Help
- **Using:** Launch from ISA with host & port (1972)
- **Views:**
 - Classes
 - Environment
 - Garbage Collection
 - I/O (New!)
 - Locking
 - Native Memory
 - Profiling

See also SHARE 113 (Denver) Presentation – Session 1153

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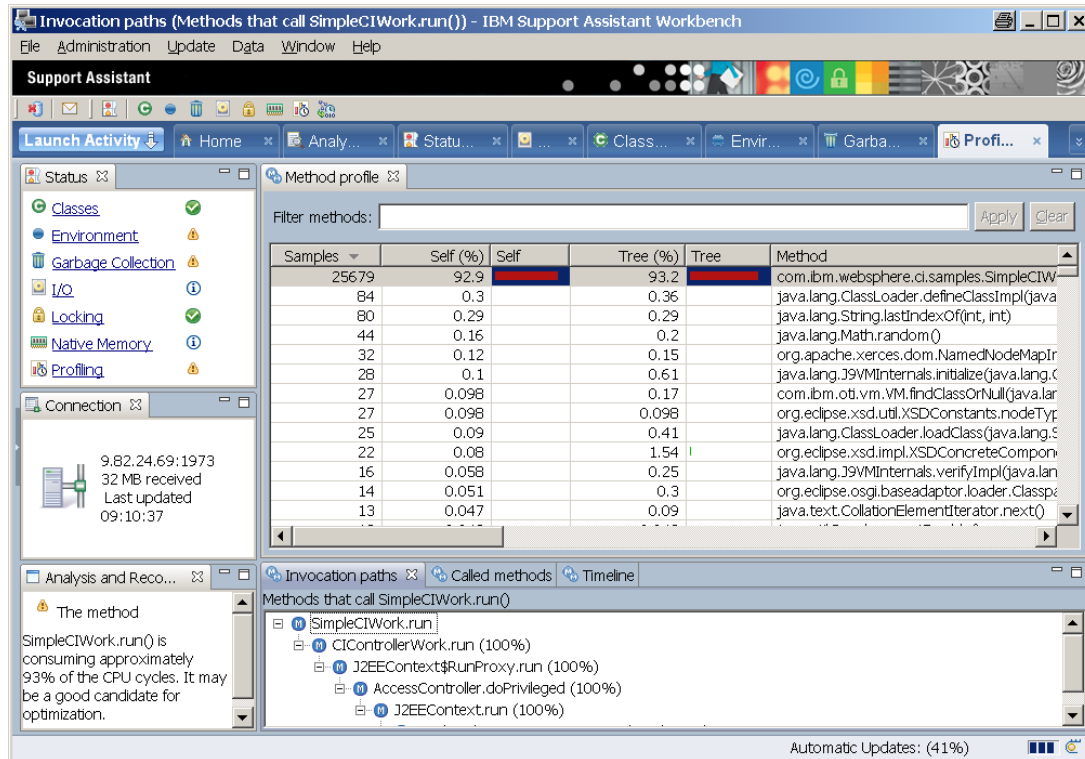
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Health Center - Profiling

- Lower overhead *than Jinsight Live for z, but not as rich.*



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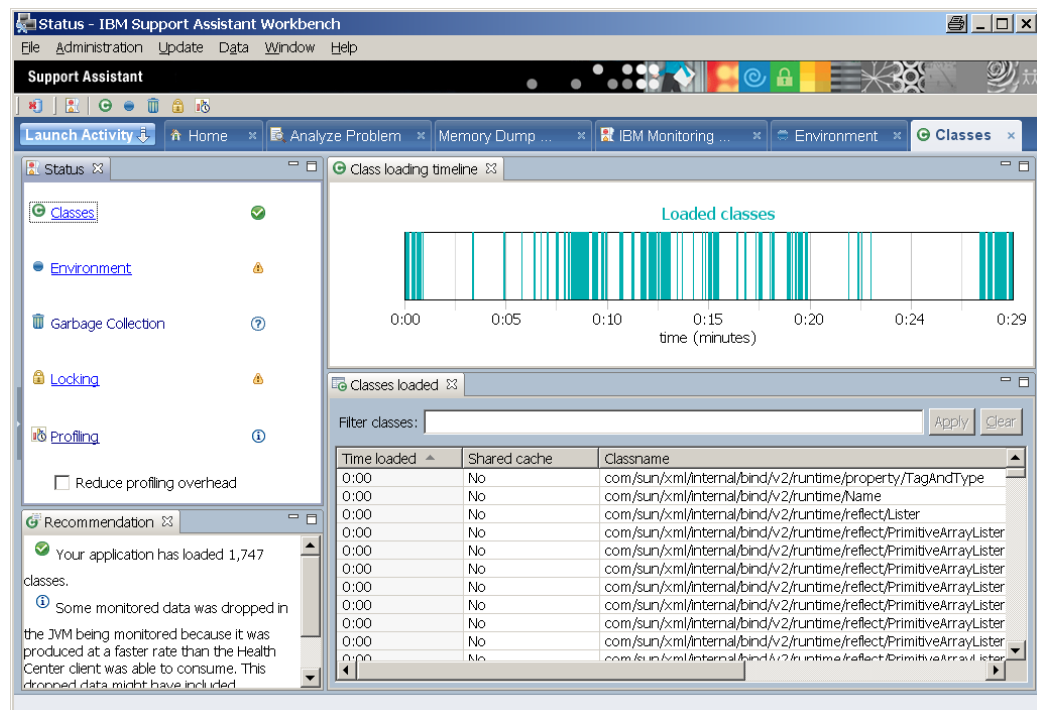
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Health Center - Classes

- Timeline shows Class Loading frequency



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Health Center - Environment

- Verify environmental variables, and Classpath setting

The screenshot shows the 'Configuration - IBM Support Assistant Workbench' window with the 'Environment' tab selected. The left pane shows a tree view with 'Environment' highlighted. The main pane displays a list of properties and their values for the Java Virtual Machine and System.

Property	Value
Boot classpath	
Classpath	
Java parameters	-Dcom.ibm.CORBA.iop.noLocalCopies=false -Dcom.ibm.itp.location=/wasv7config/h2cell/h2nodeb/AppServer/bin -Dcom.ibm.oti.vm.bootstrap.library.path=/wasv7config/h2cell/h2nodeb/AppServer/java -Dcom.ibm.security -Dfile.encoding=ISO8859-1 -Djava.awt.headless=true -Djava.class.path=/wasv7config/h2cell/h2nodeb/AppServer/profiles/default/properties/v -Djava.ext.dirs=/wasv7config/h2cell/h2nodeb/AppServer/java/lib/ext -Djava.ext.dirs=/wasv7config/h2cell/h2nodeb/AppServer/java/lib/ext:/wasv7config/h2c

Property	Value
Full version	J2RE 1.6.0 IBM J9 2.4 z/C
Java home	/wasv7config/h2cell/h2nc
Java vendor	IBM Corporation
Java virtual machine name	IBM J9 VM
Process id	196834
Version	1.6

Property	Value
Architecture	s390
Number of available processors	2
Operating system	z/OS
Operating system version	0.1.10.00

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Health Center – Garbage Collection

- Graph shows Heap Use, Size, and Pause Times

The screenshot shows the 'Pause Times - IBM Support Assistant Workbench' window with the 'Garbage Collection' tab selected. The left pane shows a tree view with 'Garbage Collection' highlighted. The main pane displays two graphs and a summary table.

Used heap (after collection) and Heap size

The graph shows 'Used heap (after collection)' (blue line) and 'Heap size' (red line) over time. The y-axis is 'size (MB)' ranging from 0 to 250. The x-axis is 'time (minutes)' ranging from 0:00 to 2:30. The blue line shows a steady increase from approximately 50 MB to 100 MB. The red line is a horizontal line at approximately 250 MB.

Pause times (not including exclusive)

The graph shows 'Pause times (not including exclusive)' (green line) over time. The y-axis is 'time (ms)' ranging from 0 to 200. The x-axis is 'time (minutes)' ranging from 0:00 to 2:30. The green line shows a sharp initial spike to approximately 200 ms, followed by a steady increase to approximately 150 ms.

Summary

Property	Value
Allocation failure count	4
GC Mode	Default (optthruput)
Largest memory request	8.02 KB
Mean garbage collection pause	108 ms
Mean heap unusable due to fragmentation	10.9 MB
Mean interval between collections	0.47 minutes
Proportion of time spent unpaused	99.6%
Rate of garbage collection	317 MB/minute
System (forced) garbage collection count	3
Time spent in garbage collection pauses	0.44%

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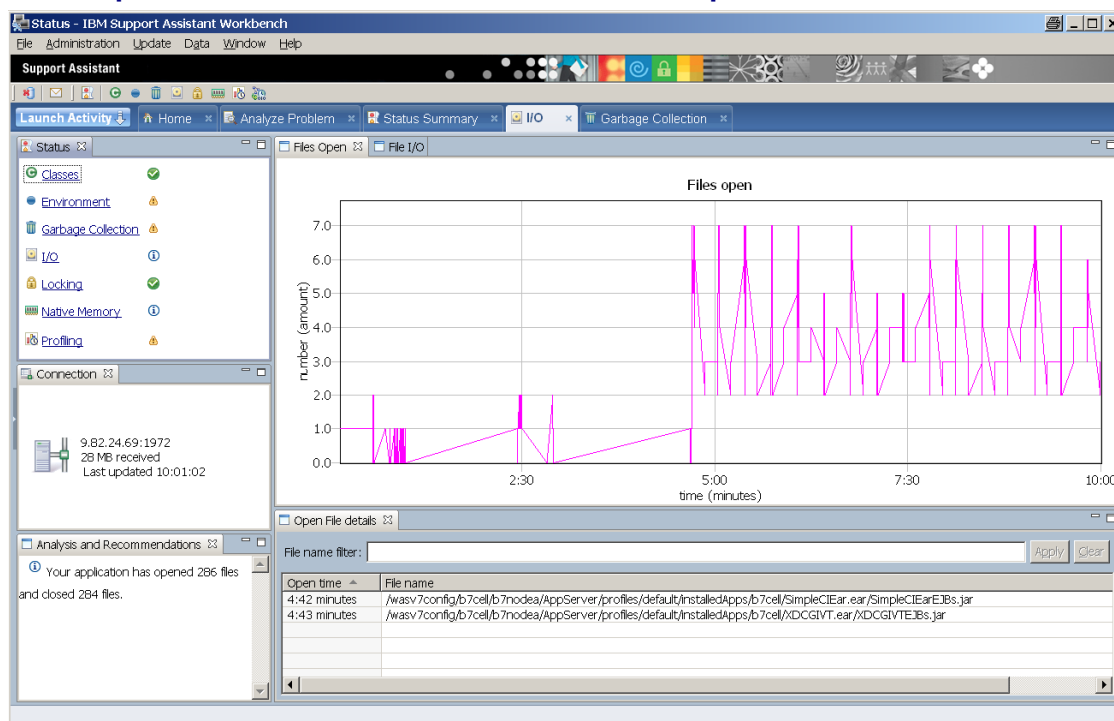
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Analyzing

Health Center – I/O View

- Graph shows Number of Files Open over Time



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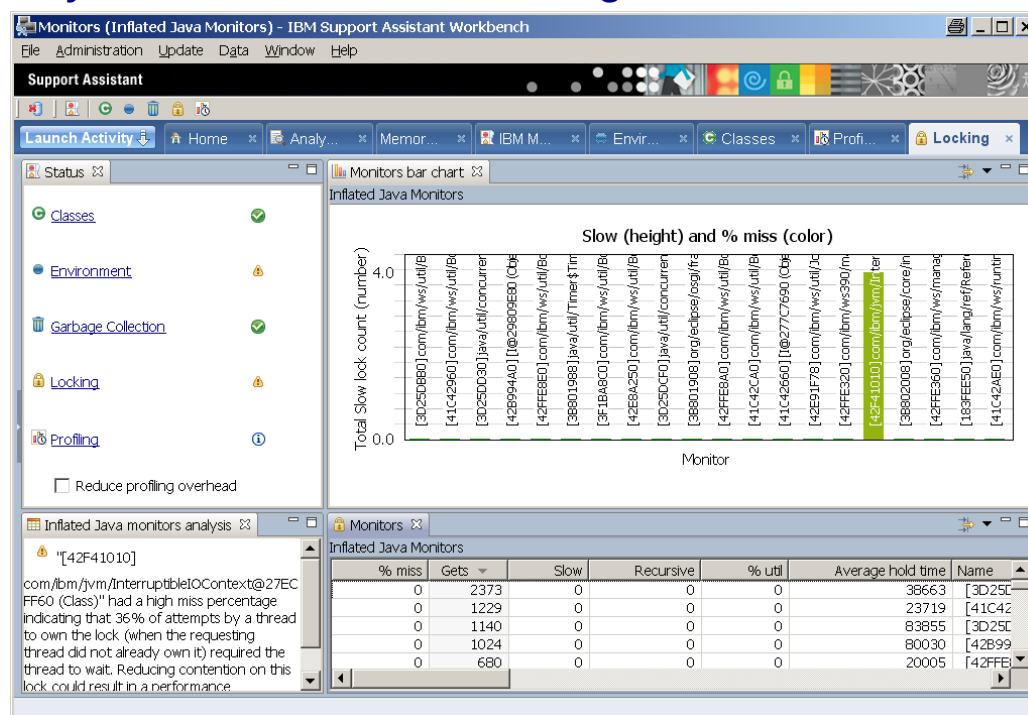
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Health Center - Locking

- Identify Lock Contention and avg. Lock Hold Times



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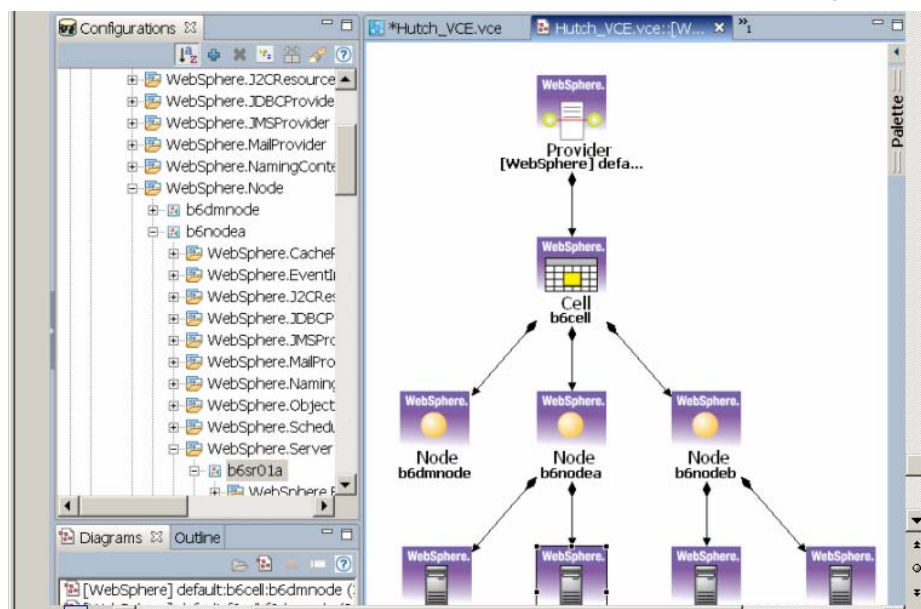
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Visual Configuration Explorer (VCE)

Visualize, explore, and analyze configuration information
Correlate configuration information between different products
Collaborate with others during problem analysis
Also see SHARE 113 Session 1153 for more examples...



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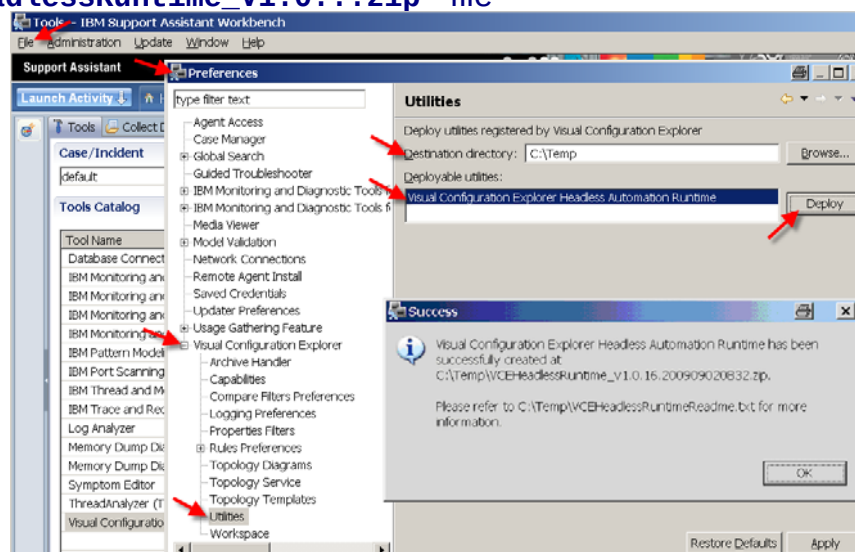
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ISA VCE "Headless Installation"

Click on File → Preferences → VCE → Utilities → "Deploy" to create
VCEHeadlessRuntime_V1.0...zip file



Transfer zip file to your USS working directory, and unzip to .vce dir.

```
jar -xvf VCEHeadlessRuntime_V1.0.15.20090624.0925.zip
```

Run the exporter from .vce/ directory after setting WAS_HOME:

```
Java jar startup.jar -buildfile wasexporter/wasexport.xml -dwas.root=$WAS_HOME
```

FTP the wasexport.xml configuration file to your workstation and re-name it.

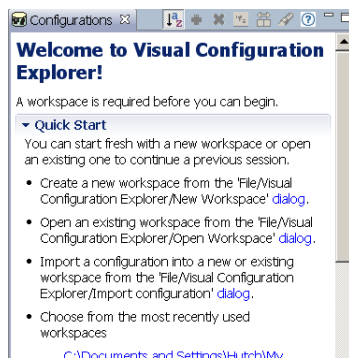
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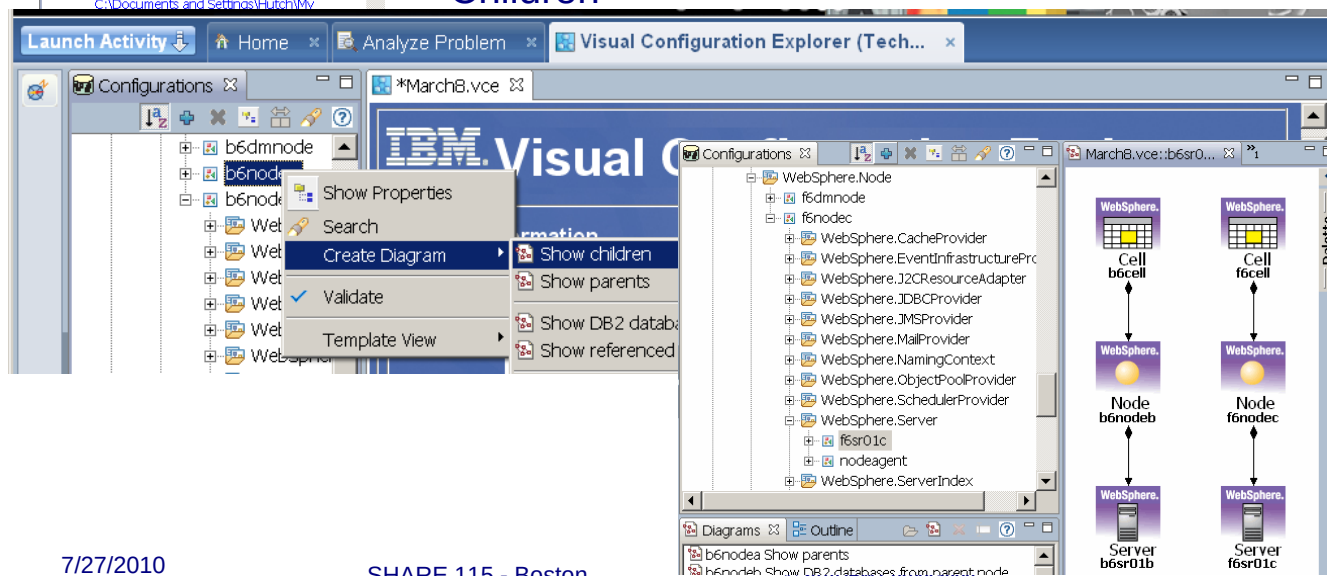
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VCE Quick Start



- Create Workspace
- Add Configuration(s) Add Configuration  tool
- Create New Diagram New Diagram  tool
- Drag objects to diagram
- Show Parents or Children

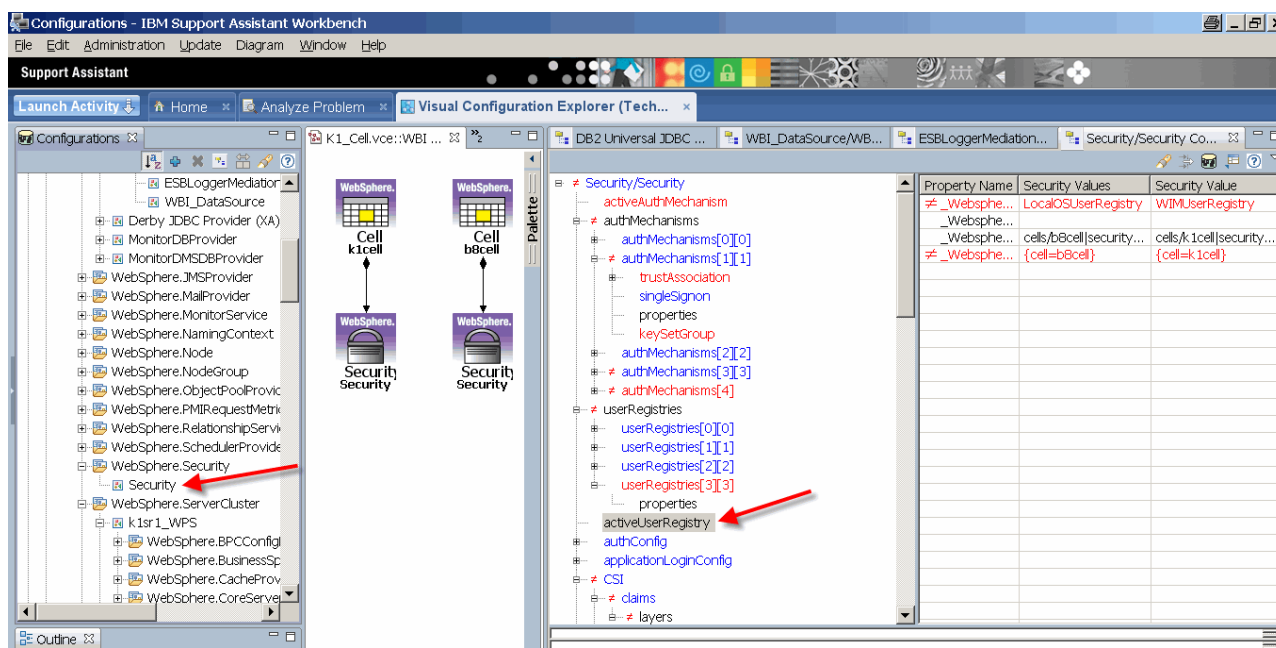
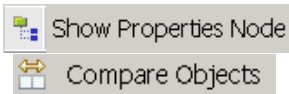


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Comparing Object Properties

- Right-Click on “Show Properties Node”
- Right-Click on “Compare Objects”



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- **Installing the ISA**
- **Other Diagnostic Tools for WebSphere on z/OS**
 - MVS Modify (F) commands
- **Working with Dumps & Traces**
 - Triggering dumps & Traces
 - Extracting system dumps for ISA tools
- **Testing Tools & Sample Applications**
- **Documentation, Help & Web Resources**

Installing the IBM Support Assistant (ISA)

- **Download & Install ISA**
 - <http://www.ibm.com/software/support/isa/>
 - See IEA (IBM Education Assistant) for tutorials:
 - http://publib.boulder.ibm.com/infocenter/ieduasst/v1r1m0/index.jsp?topic=/com.ibm.iea.selfassist/selfassist/ISAv41_Task.html
 - Install Product Add-ons: (100's)
 - ISA: Update > Find New... > Tools Add-ons
 - <http://www.ibm.com/support/docview.wss?uid=swg27013279>

Other Diagnostic Tools for WebSphere



- WebSphere “built-in” tools (See InfoCenter)
 - Display server - MVS Modify commands
 - Trace Dynamically - MVS Modify (F) commands
 - Performance Monitor (PMI) & Viewer
 - threadmonitor (WAS V7)
 - dumpNameSpace
 - wsadmin
 - ISC
- Other:
 - JinsightLive for IBM System z
<http://www.alphaworks.ibm.com/tech/jinsightlive>



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The all-powerful MVS Modify command



F <server_name>, HELP

- TRACEALL - Set overall trace level
- TRACEBASIC - Set basic trace components
- TRACEDETAIL - Set detailed trace components
- TRACESPECIFIC - Set specific trace points
- TRACEINIT - Reset to initial trace settings
- TRACENONE - Turn off all tracing
- JAVACORE - Generate jvm core dump
- HEAPDUMP - Generate jvm heap dump
- JAVATDUMP - Generate jvm tdump
- TRACEJAVA - Set java trace options

F <server_name>, DISPLAY, HELP

- LISTENERS - Display listeners
- CONNECTIONS - Display connection information
- TRACE - Display information about trace settings
- JVMHEAP - Display jvm heap statistics
- WORK - Display work elements
- ERRLOG - Display the last 10 entries in the error log
- THREADS - Display thread status

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Working with Dumps



- **Java Dumps** > /var/home/... MVS console commands
 - **Heap:** MVS command: **F <server_name>, HEAPDUMP**
 - **Core:** **F <server_name>, JAVACORE**
 - **JVM TDUMP:** **F <server_name>, JAVATDUMP**Heapdumps (and javacore) written to home dir
(Default = /var/WebSphere/home/cell/<servant Group ID>)
- **WebSphere ABEND dumps** > /var/home/...
- **SYSABEND & CEE Dumps** > JES SPOOL
- **SVC Dumps, ABEND Dumps** > SYS1.DUMP.Dyy
 - Setup Dump Options:
CD SET,SDUMP=(RGN)
D DUMP,0
SDUMP- ADD OPTIONS (LSQA,RGN,TRT)
 - MVS Dump console command:
Dump COMM='title'
R nn,jobname=H7SR01AS

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jextract - Convert SVC dump for Dump Analyzer



- jextract is shipped with the IBM JVM in the ../java/bin/ directory
- Point directly to the Dump dataset:

```
/shared/zWebSphere/V7R0/java64/J6.0_64/bin/jextract SYS1.DUMP.D091014.T102814.SYSB.S00003
Loading dump file...
Read memory image from SYS1.DUMP.D091014.T102814.SYSB.S00003
Set debug scratch space size to 8 MB
VM set to 000000080B178548
Dumping JExtract file to SYS1.DUMP.D091014.T102814.SYSB.S00003.xml
<!-- extracting gpf state --> <!-- 5ms -->
<!-- extracting host network data --> <!-- 9ms -->
<!-- extracting classes --> <!-- 183200ms -->
<!-- extracting monitors --> .<!-- 188234ms -->
<!-- extracting threads --> .<!-- 195727ms -->
<!-- extracting trace buffers --> <!-- 195740ms -->
<!-- extracting roots -->.<!-- 199500ms -->
<!-- extracting objects --> .<!-- 268266ms -->
Finished writing jextract XML file in 268268ms
Warning: found 14 inconsistencies in the dump file. Further information has been written to the
jextract XML file
Creating archive file: SYS1.DUMP.D091014.T102814.SYSB.S00003.zip
Adding "SYS1.DUMP.D091014.T102814.SYSB.S00003"
Adding "SYS1.DUMP.D091014.T102814.SYSB.S00003.xml"
Adding "/shared/zWebSphere/V7R0/java64/J6.0_64/lib/TraceFormat.dat"
Adding "/shared/zWebSphere/V7R0/java64/J6.0_64/lib/J9TraceFormat.dat"
jextract complete..
```

- FTP the resulting .zip file to your workstation.
- May have to specify these arguments:
export J9DBGEXT_SCRATCH_SIZE=8
jextract -J-DJavaio.tmpdir=/u/hutch/largezfs-Xmx1024 SYS1.DUMP.D091014.

jdmppview - Replaced by the ISA Dump Analyzer or Memory Analyzer?

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Testing Tools

- Load Drivers
 - JMeter
 - Microsoft™ Web Application Stress Tool
 - LoadRunner, Silk, ...
- Sample Applications
 - Techdoc WP101612 “Getting started with analysis of GC, Heapdumps and Javacores For WebSphere on z/OS”
 - PD Application Tools: causeOutOfMemory, Sleeper

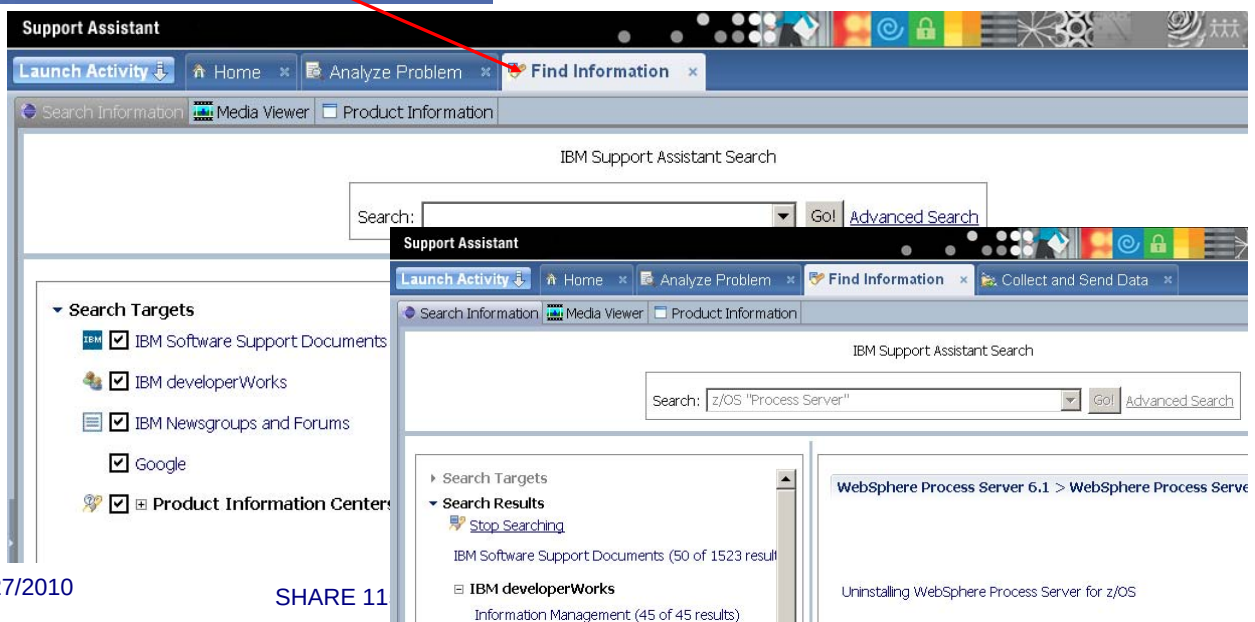
ISA Built-in Documentation (local eclipse):

Welcome to IBM Support Assistant



Find Information
Easily find the information you need including product specific information and search capabilities

“Find Information” - Search

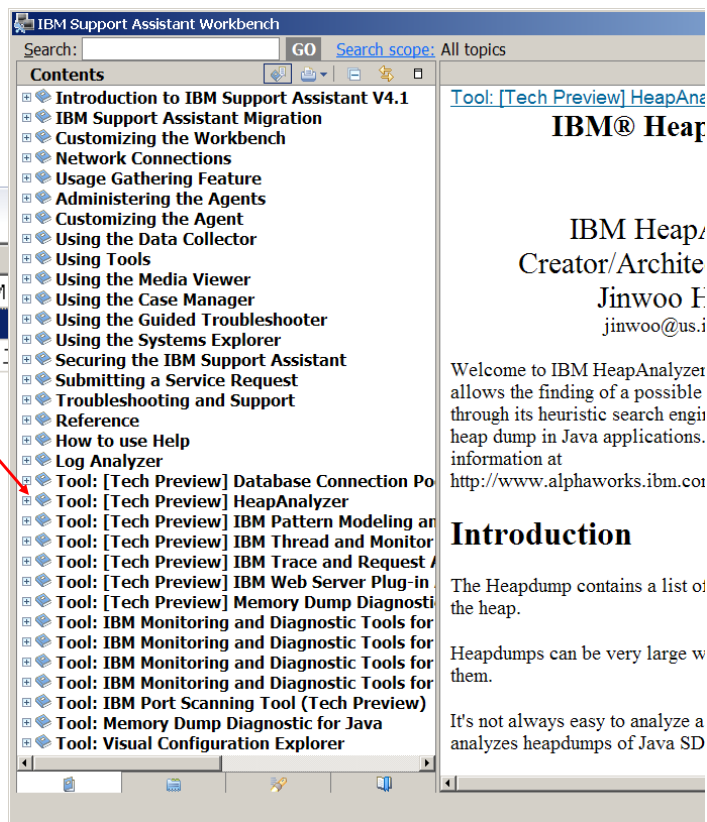
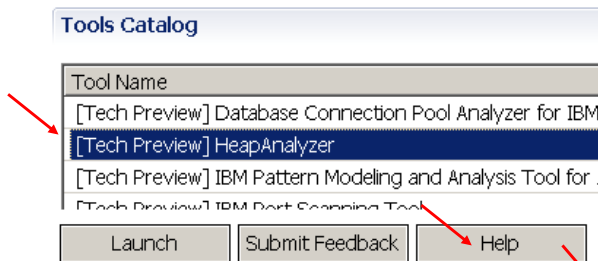


The screenshot displays the IBM Support Assistant application window. The top bar shows tabs for 'Launch Activity', 'Home', 'Analyze Problem', and 'Find Information'. Below this, there are sections for 'Search Information', 'Media Viewer', and 'Product Information'. The main area is titled 'IBM Support Assistant Search' and contains a search bar with the text 'z/OS Process Server'. To the left, there is a 'Search Targets' list with checkboxes for 'IBM Software Support Documents', 'IBM developerWorks', 'IBM Newsgroups and Forums', 'Google', and 'Product Information Center'. The search results are displayed on the right, showing 'WebSphere Process Server 6.1 > WebSphere Process Server' and 'Uninstalling WebSphere Process Server for z/OS'.

ISA Help

<http://localhost:1260/help/index.jsp>

- Highlight a tool
(e.g., HeapAnalyzer)
- Click on the “Help” tab:



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ISA Resources

ISA website:

www.ibm.com/support/docview.wss?rs=3455&uid=swg27012682

www.ibm.com/support/docview.wss?rs=3455&context=SSLLVC&q1=vce&uid=swg27013116

ISA Download website www.ibm.com/software/support/isa/download.html

ISA V4.1.1 ReadMe www.ibm.com/support/docview.wss?uid=swg27016886

IBM Support Assistant Team www.ibm.com/software/support/isa

ISA Forum www.ibm.com/developerworks/forums/forum.jspa?forumID=935

Comments/feedback to: IBMSA@us.ibm.com

IBM Education Assistant (IEA) tutorials:

publib.boulder.ibm.com/infocenter/ieduasst/v1r1m0/index.jsp?topic=/com.ibm.iea.selfassist/selfassist/ISAv41_Task.html

IBM Diagnostics Guides www.ibm.com/developerworks/java/jdk/diagnosis/index.html

IBM Techdocs at www.ibm.com/support/techdocs: [WP101575](#) & [WP101612](#)

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