Debug 101-Using ISA Tools for Apps in WebSphere Application Server z/OS

Session 16509

Mike Stephen - msteff@us.ibm.com

Joran Siu – joransiu@ca.ibm.com

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WebSphere Application Server

Session	Title	Time	Room	Speaker
16379	WebSphere Liberty Profle, Windows and z/OS, Hands-on Lab	Monday 4:30	Redwood	Follis/Stephen
16380	z/OS Connect: Opening up z/OS Assets to the Cloud and Mobile Worlds	Tuesday 1:45	Virginia	David Follis
16381	WebSphere Liberty Profile and Traditional WebSphere Application Server – What's New?	Tuesday 3:15	University	Follis/Stephen
16509	Debug 101-Using ISA Tools for Apps in WebSphere Application Server z/OS	Wednesday 3:15	Virginia	Mike Stephen, Joran Siu
16383	IBM Installation Manager for z/OS System Programmers: Web-based Installs, Fix Packs, and How iFixes Really Work.	Thursday 8:30	University	Don Bagwell, Bryant Panyarachun
16384	JSR 352 - The Future of Java Batch and WebSphere Compute Grid	Thursday 10:00	University	David Follis
16382	Common Problems and Other Things You Should Know about WAS on z/OS	Thursday 4:30	Virginia	Mike Stephen
16385	Configuring Timeouts for WebSphere Application Server on z/OS	Friday 10:00	Virginia	Follis/Stephen

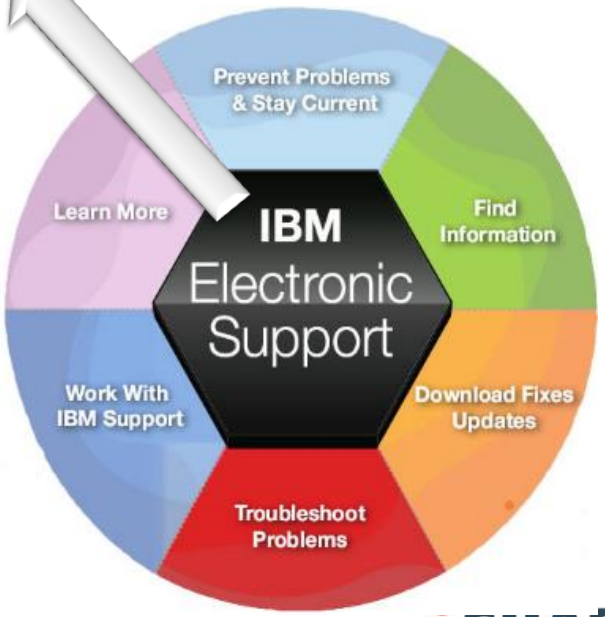
Intro to ISA V5

Modes of Support Interaction

Automation

Direct personal intervention

- Product or System self-healing
- Standard “phone” support
- Accelerated Value Program
- Critical Situations – “SWAT” teams
- Special IBM Services Engagements



Key Components of the Serviceability Strategy

- **Serviceability Framework / Delivery Platforms**
  - Web-based eSupport resources, Support Portal, **IBM Support Assistant (ISA), ISA Data Collector**, Fix Central, Archive Explorer, …
- **Knowledge and Education**
  - Technotes, Knowledge Engineering, IBM Education Assistant, WAS Support Technical Exchange, dW Answers, Problem Determination Courses, …
- **Problem Determination Tools**
  - Java Health Center, Memory Analyzer, Automated Analysis, Cross-component Trace Viewer, Trace and Request Analyzer, WebSphere Config Visualizer, …
- **Serviceability features in the product**
  - Log/trace, FFDC, hung thread detection, serviceability defect process, …
- **Metrics and PMR Causal Analysis**
  - RETAIN statistics, OPC, Aged PMR reviews, SWAT debriefs, ad-hoc PMR reviews, …

Many deliverables are the result of collaboration between many different teams – they are all discussed here without regard to origin

Some Notes about Problem Determination Tools

- **The development of Problem Determination tools within IBM is not centralized**
  - Various product teams, support teams and individuals create their own tools
  - The Serviceability Tools Team coordinates these various offerings and manages the platform
  - Trying to centralize as many tools as possible in IBM Support Assistant or integrated in a Product
- **Sometimes there will be several tools with overlapping functions**
  - Various individuals may have their preferences for one tool over another
  - The Serviceability Tools Team will help clarify and designate the tool(s) that are officially "preferred" by IBM for its Clients
- **Tools evolve over time**
  - Today's "best-of-breed" tool may be replaced by an even better one someday
  - The Serviceability Tools Team manages the orderly deprecation and withdrawal of older tools when appropriate
- **The current strategic push is towards server-based tools**
  - To facilitate deployment in cloud-type environments, such as IBM Support Assistant 5.0

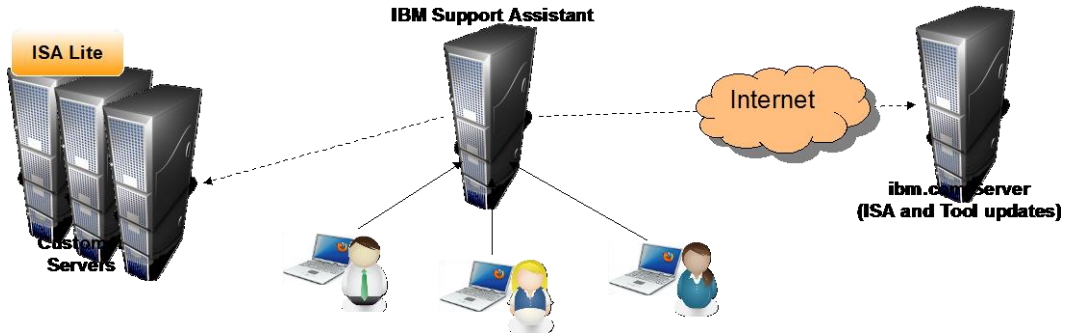
IBM Support Assistant 5

- **What is IBM Support Assistant 5?**
  - Application targeted toward users responsible for diagnostics and root cause analysis
  - A long-range strategy to produce a **collaborative problem determination platform**
  - A **convergence** and **next generation** of several tools

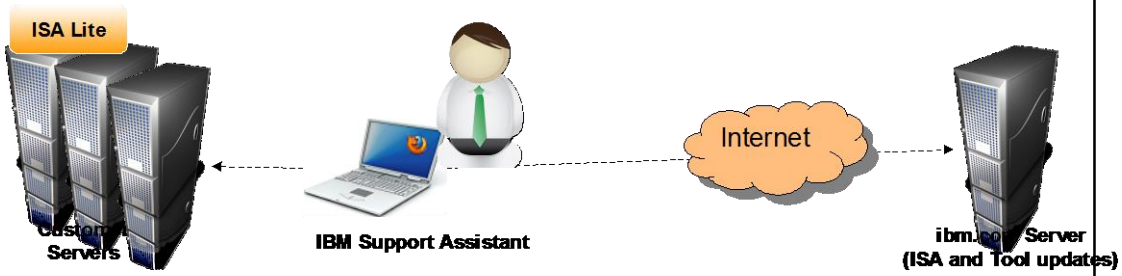
- **Benefit Focus areas**
  - **Cost avoidance** through reduction in time to resolution and PMR avoidance
  - **Saves time** installing/updating client software: click “refresh” to get the latest version
  - **Saves time, ensures completeness and consistency** when trudging through large volumes of diagnostic data to find that “needle in a haystack”
  - **Saves desktop resources** by off-loading heavyweight tools to shared servers
  - **Saves time** communicating with customers and collaborating between Support Engineers

IBM Support Assistant 5.0 – Deployment options

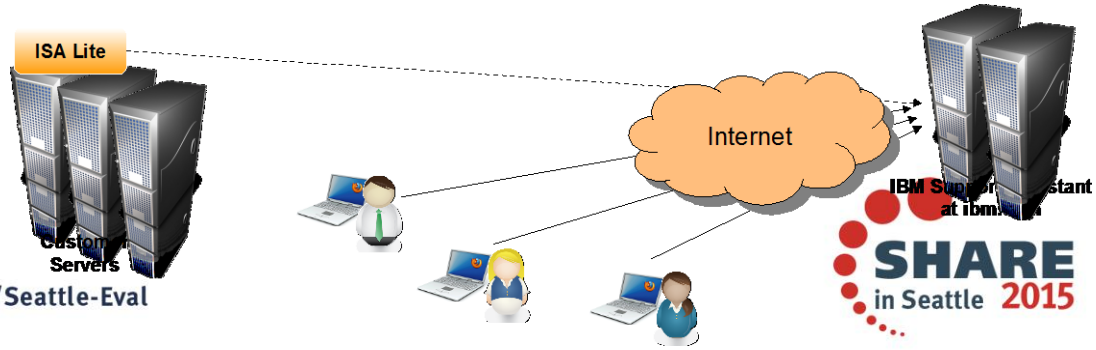
Team Server
- Single install
- Multiple end users
- Leverages resources of ISA server system
- Shared investigation



Standalone
- Single user
- Local install
- User administered



Cloud *(future?)*
- Zero install
- Multiple end users
- Leverages resources of ISA at ibm.com
- Shared investigation



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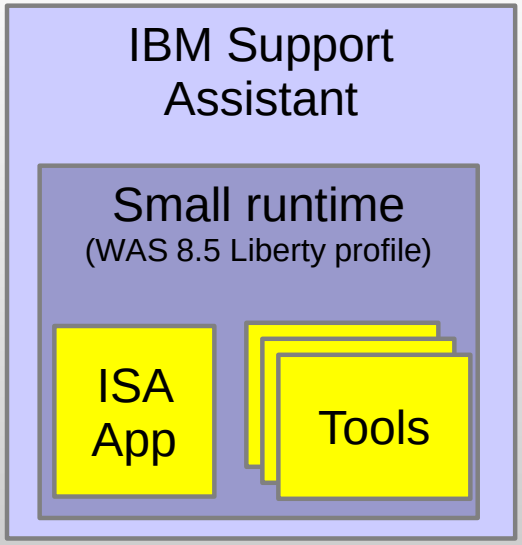
IBM Support Assistant 5.0 – Installation options

Installation Manager

Recommended

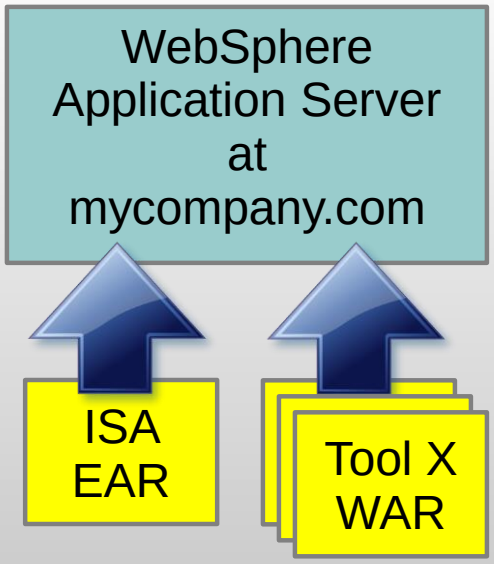
- *Managed install, uninstall and update*
- *Selective install of tools*
- *All-in-one solution – includes lightweight runtime*



optional

EAR:

- *Deploy into existing Application Server*
- *Tools deployed as JEE web modules*



Compressed zip

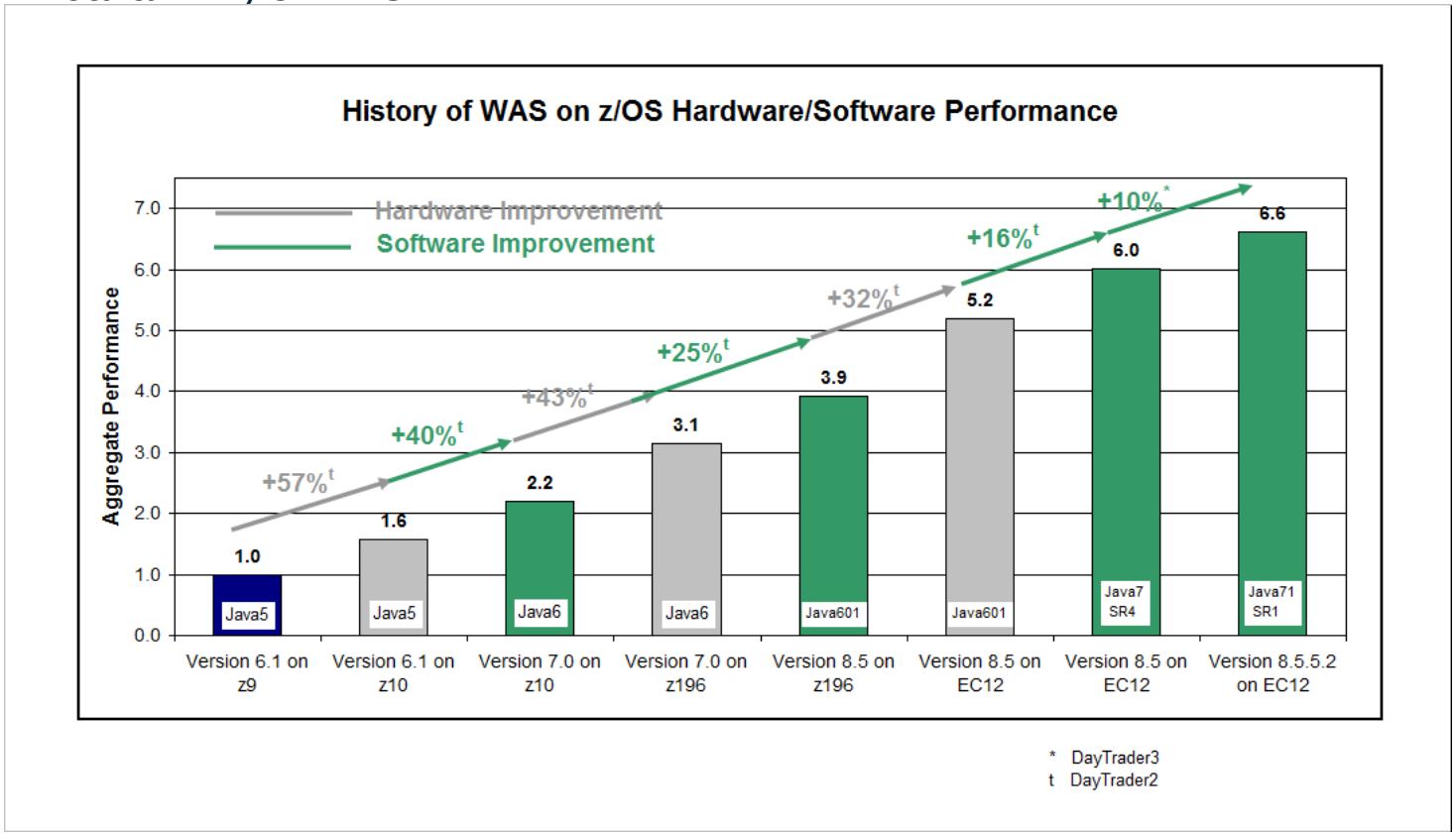
- *Easy startup*
- *Unzip and go*
- *All tools included*
- *No update capabilities*

IBM SDK Java Tech. Edition, Version 8 (IBM Java 8)

- **New Java8 Language Features**
  - Lambdas, virtual extension methods
- **IBM z13 exploitation**
  - Vector exploitation and other new instructions
  - Instruction scheduling
- **General throughput improvements**
  - Up-to 17% better application throughput
  - Significant improvements to ORB
- **Improved crypto performance for IBMJCE**
  - Block ciphering, secure hashing and public key
    - Up-to 4x improvement to Public Key using ECC
    - CPACF instructions: AES, 3DES, SHA1, SHA2, etc
- **Significantly improved application ramp-up**
  - Up-to 50% less CPU to ramp-up to steady-state
  - Improved perf of ahead-of-time compiled code
- **Improved Monitoring**
  - JMX beans for precise CPU-time monitoring
- **Enhancements to JZOS Toolkit for Java batch**

WAS on z/OS – DayTrader

- Aggregate HW, SDK and WAS Improvement: WAS 6.1 (IBM Java 5) on z9 to WAS 8.5 (IBM Java 7R1) on zEC12

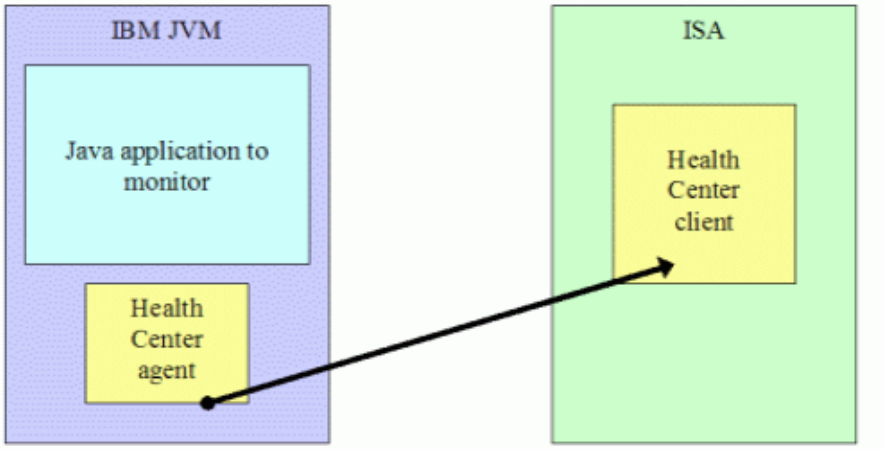


6.6x aggregate hardware and software improvement comparing WAS 6.1 IBM Java5 on z9 to WAS 8.5.5.2 IBM Java7R1 on zEC12

(Controlled measurement environment, results may vary)

Java Monitoring and Diagnostic Tooling Health Center - Installation

- The tool is provided in two parts:
  - An Agent that collects data from a running application
  - An Eclipse-based client that connects to the agent



- The Agent ships with the following vm's:
  - Java 5sr9 and upwards
  - Java 6sr3 and upwards

- The latest version of the agent is always available from within the Health Center Client
  - Recommended to always update to the latest version of the agent
  - Agent package unzips over the jre directory of the JVM you are using

Java Monitoring and Diagnostic Tooling Health Center - Enable for Monitoring

- Full instructions are provided within the help shipped with the Health Center Client but in most cases as simple as:

For Java 5 SR10 and later or Java 6 SR5 and later, including Java 7 (can be used in production)

```
java –Xhealthcenter HelloWorld
```

For Java 5 SR9 and earlier, or Java 6 SR4 and earlier
(not recommended for use in a production environment)

```
java –agentlib:healthcenter –Xtrace:output=healthcenter.out HelloWorld
```

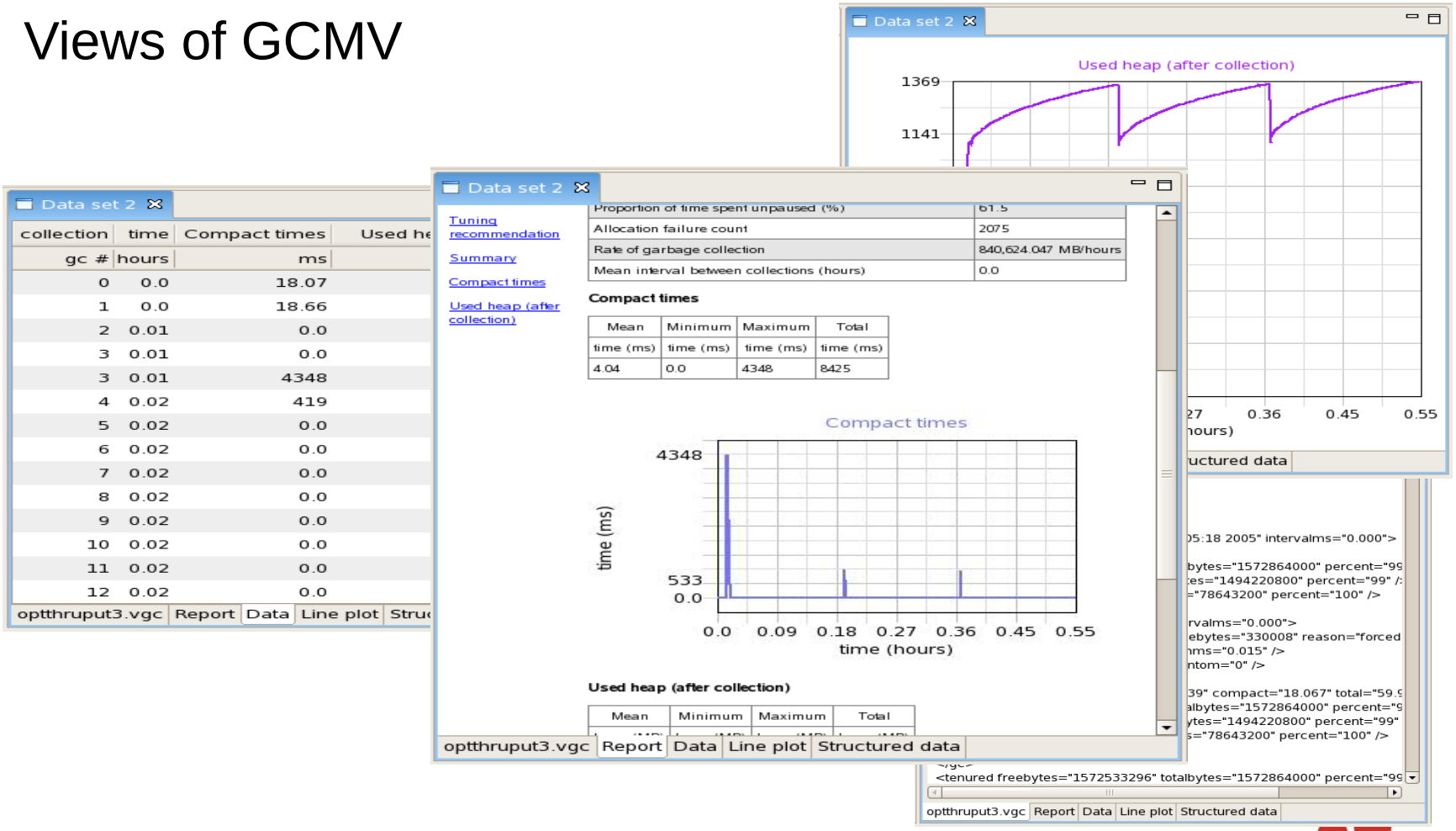
Java Monitoring and Diagnostic Tooling Health Center – Advanced Options

- Headless mode for data collection without connecting the GUI
  - Useful for scenarios where firewall blocks connection
  - Configurable to limit disk space used
  - Timed collections
  - Interval based collections
  - Started with

    -Xhealthcenter:level=headless
- Late attach enabled

Java Monitoring and Diagnostic Tooling Garbage Collector and Memory Visualizer (GCMV)

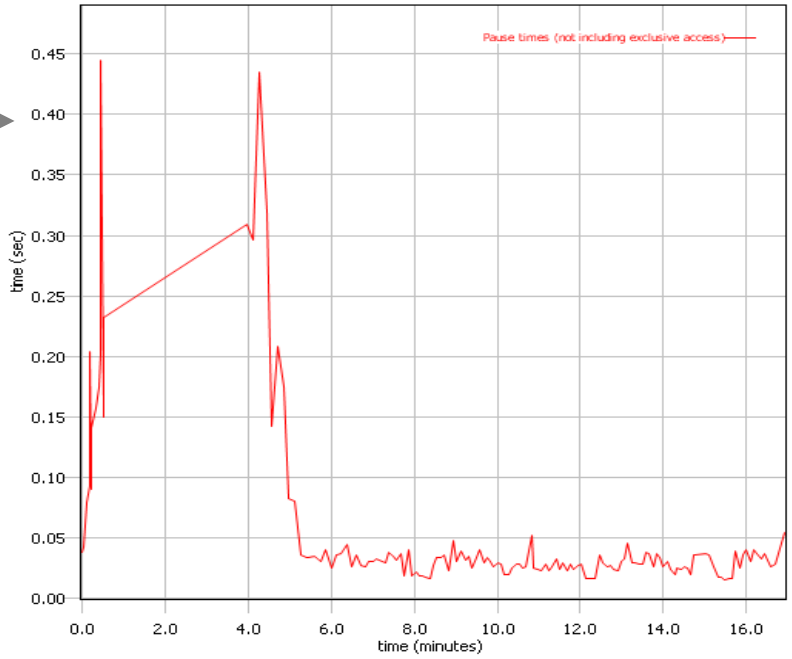
- Views of GCMV



Java Monitoring and Diagnostic Tooling Garbage Collector and Memory Visualizer (GCMV)

Graphical Display of Data

- Allows graphing of all available data: pause times, heap size etc
- Allows zoom, cropping and change of axes value and units
- Allows comparison of multiple files



Tuning recommendation

The garbage collector seems to be compacting excessively. On average 45% of each pause was spent compacting the heap. Compaction occurred on 40% of collections. Possible causes of excessive compaction include the heap size being too small or the application allocating objects that are larger than any contiguous block of free space on the heap.

The garbage collector is performing system (forced) GCs. 5 out of 145 collections (3.448%) were triggered by System.gc() calls. The use of System.gc() is generally not recommended since they can cause long pauses and do not allow the garbage collection algorithms to optimise themselves. Consider inspecting your code for occurrences of System.gc().

The mean occupancy in the nursery is 7%. This is low, so the gencon policy is probably an optimal policy for this workload.

The mean occupancy in the tenured area is 14%. This is low, so you have some room to shrink the heap if required.

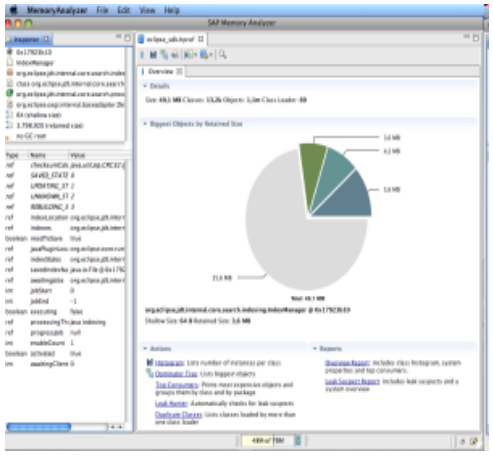
Summary

Allocation failure count	140
Concurrent collection count	0
Forced collection count	5
GC Mode	gencon
Global collections - Mean garbage collection pause (ms)	185
Global collections - Mean interval between collections (minutes)	0.13
Global collections - Number of collections	5
Global collections - Total amount tenured (MB)	93.1
Largest memory request (bytes)	127784
Minor collections - Mean garbage collection pause (ms)	48.2
Minor collections - Mean interval between collections (ms)	7193
Minor collections - Number of collections	140
Minor collections - Total amount flipped (MB)	668
Minor collections - Total amount tenured (MB)	38.8
Proportion of time spent in garbage collection pauses (%)	0.76
Proportion of time spent unpaused (%)	99.24
Rate of garbage collection (MB/minutes)	874

Analysis and Recommendations

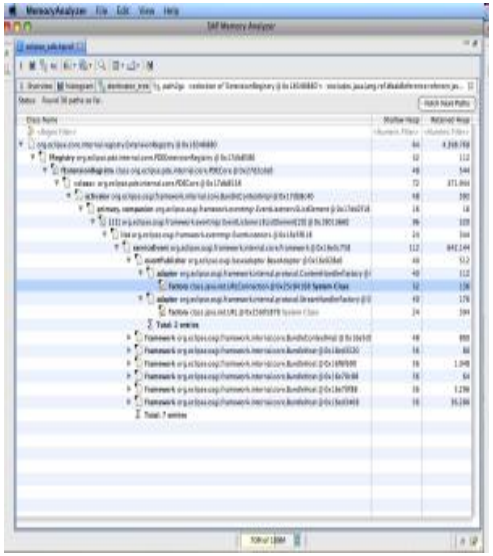
- Provides tuning recommendations based on data and flags errors.
- Analysis can be limited using cropping.
- Values and units used in analysis can be changed by changing axes values and units

Java Monitoring and Diagnostic Tooling
Memory Analyzer



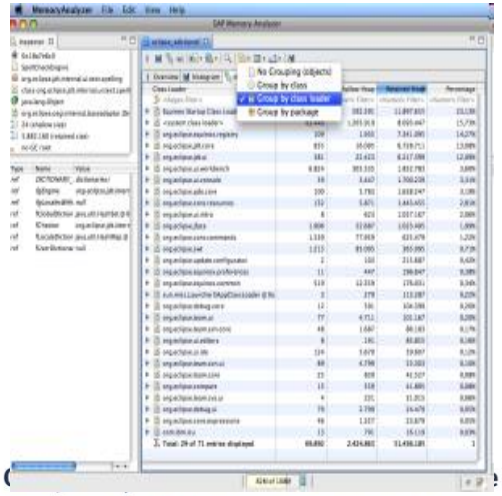
Overview:

- Overview of the heapdump including size and total number of objects.
- Provides links to continued analysis



Path to GC Roots:

- Provides the reference chain that prevents an object being garbage collected



Dominator Tree grouped by Class Loader:

- Lists the biggest objects using a “keep alive tree” Grouping by Class
- Loader limits the analysis to a single application in a JEE environment

Javacore

- Like a “CEEDUMP” for Java
- Generated automatically when JVM exits unexpectedly
- Can be triggered (-Xdump:java)
- Captures JVM configuration and high-level runtime states

- Failure reason (GPF, OOM, etc)

```
1TICHARSET     IBM-1047
1TISIGINFO     Dump Event "gpf" (00002000) received
1TIDATETIME    Date: 2015/02/15 at 07:42:09
```

Javacore

- Environment information
  - Java version
  - Command line
  - Environment variables
- Memory information (heap and VM/JIT)
- Threads Stacks
- Classes loaded

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JIT Verbose Log

- Useful if you suspect a JIT failure while compiling bytecodes to native code.
- -Xjit:verbose will show the methods compiled and at what optimization level
  - + (hot) java/lang/Math.max(II)I @ 0x10C11DA4-0x10C11DDD
- Determine which methods the JIT considers frequently executed
- To exclude methods due to JIT failures:
  - -Xjit:exclude={java/lang/Math/*}

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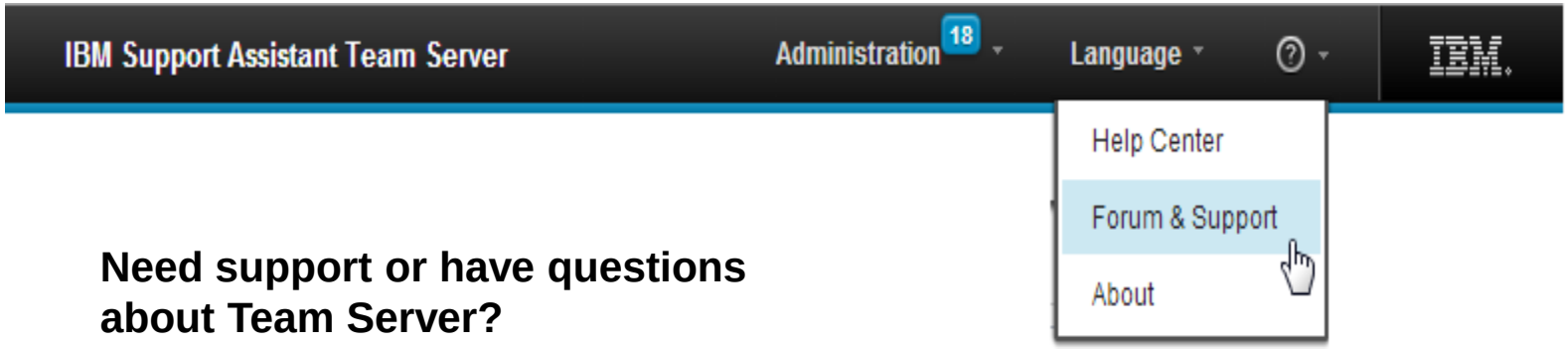

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Live in ISA 5

(cross fingers here)

WebSphere Application Server Configuration Visualizer

MAT - Memory Analyzer Tool

Health Center

QUESTIONS ??