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

Session 17363

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WebSphere Application Server
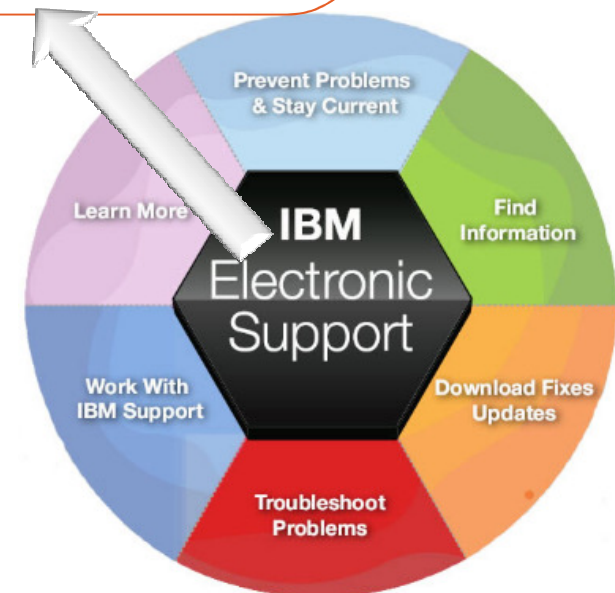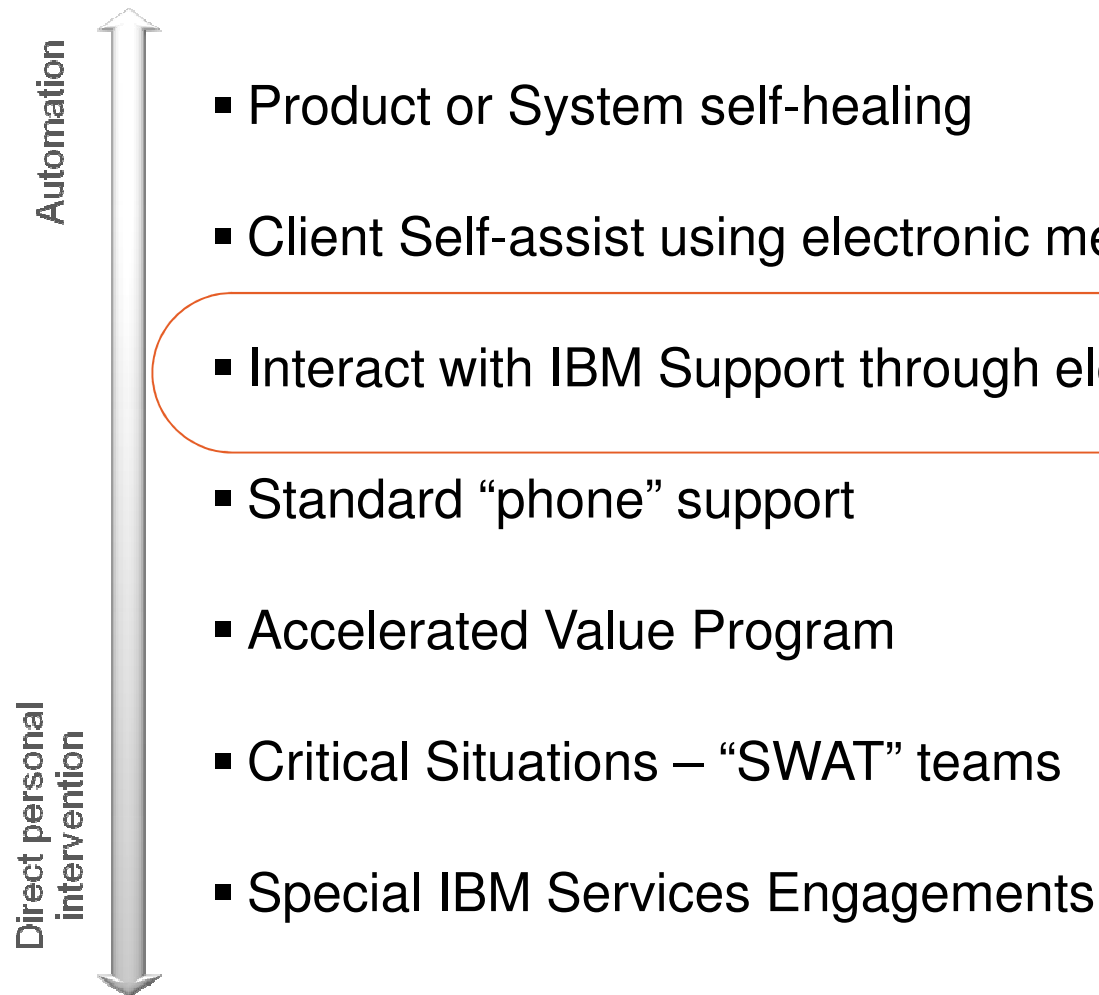
Session	Title	Time	Room
17363	Debug 101-Using ISA Tools for Apps in WebSphere Application Server z/OS	Monday 11:15	Europe 11
17367	WebSphere Liberty on Windows and z/OS (Among Other Things) Hands-On Lab	Tuesday 10:00	Asia 5
17361	ABCs of WAS	Tuesday 1:45	Oceanic 7
17368	z/OS Connect: Opening up z/OS Assets to the Cloud and Mobile Worlds	Tuesday 3:15	Oceanic 7
17362	Configuring Timeouts for WebSphere Application Server on z/OS	Wednesday 8:30	Oceanic 7
17366	WebSphere Liberty and WebSphere Application Server Classic - What's New?	Wednesday 11:15	Oceanic 7
17364	IBM Installation Manager for z/OS System Programmers: Web-based Installs, Fix Packs, and How iFixes Really Work	Thursday 4:30	Oceanic 7
17365	JSR 352 - The Future of Java Batch and WebSphere Compute Grid	Friday 10:00	Oceanic 6

SHARE in Orlando 2015

Intro to ISA V5

Modes of Support Interaction

Automation ↑
Direct personal intervention ↓

- Product or System self-healing

- Client Self-assist using electronic means

- Interact with IBM Support through electronic means

- Standard "phone" support

- Accelerated Value Program

- Critical Situations – "SWAT" teams

- Special IBM Services Engagements

Prevent Problems & Stay Current

Learn More

IBM Electronic Support

Find Information

Work With IBM Support

Download Fixes Updates

Troubleshoot Problems

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

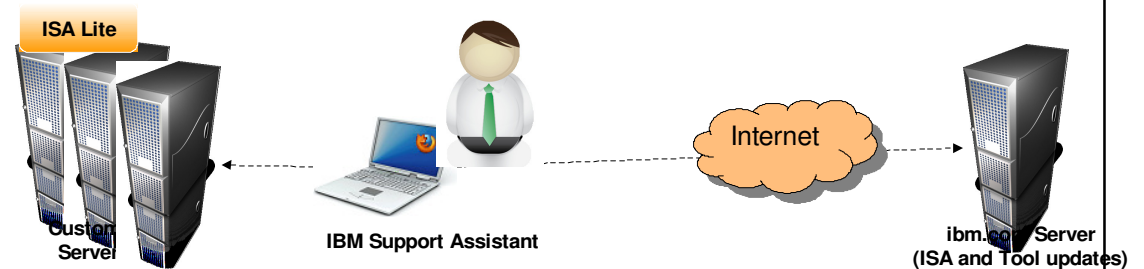**Team Server**
- Single install
- Multiple end users
- Leverages resources of ISA server system
- Shared investigation

ISA Lite

IBM Support Assistant

Internet

ibm.com Server
(ISA and Tool updates)

Custom Server
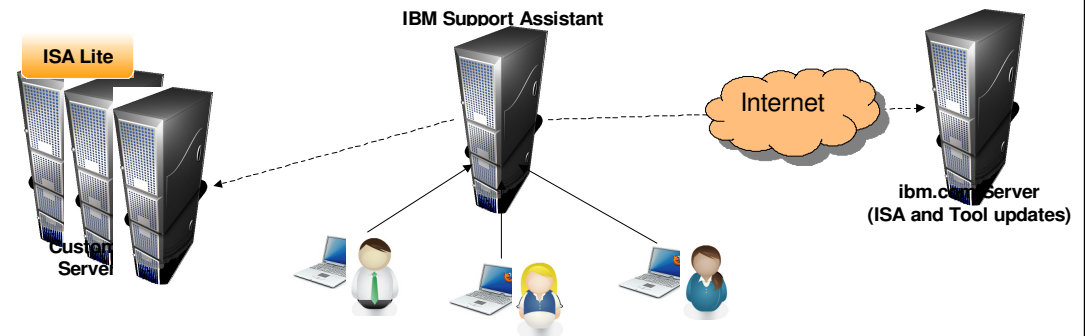
Standalone
- Single user
- Local install
- User administered

ISA Lite

Internet

Custom Server

IBM Support Assistant

ibm.com Server
(ISA and Tool updates)

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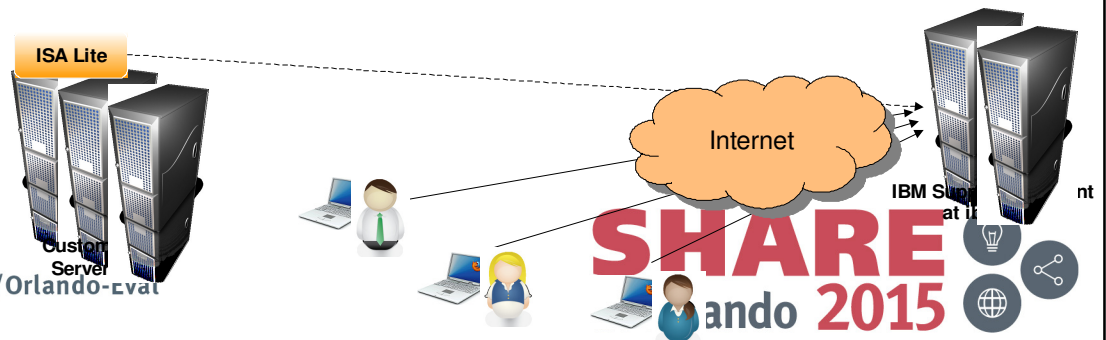
ISA Lite

Internet

IBM Support Assistant at ibm.com

Custom Server

Complete your session evaluations online at www.SHARE.org/Orlando-Eval

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IBM Support Assistant 5.0 – Installation options

Installation Manager

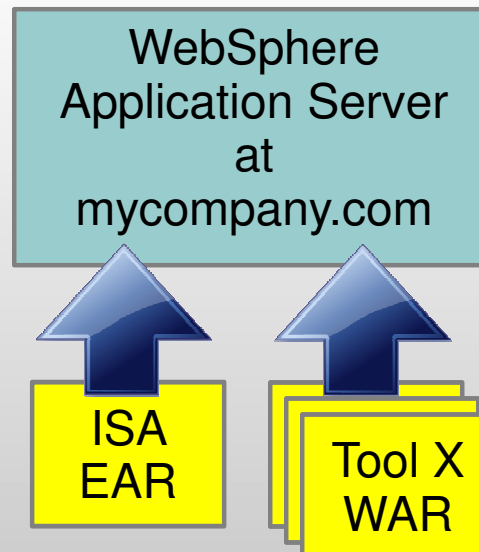### Recommended

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

IBM Support Assistant

Small runtime
(WAS 8.5 Liberty profile)

ISA App
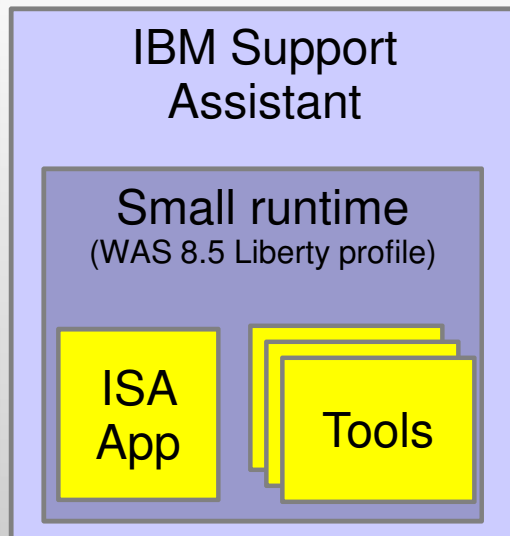
Tools

optional

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

WebSphere Application Server at mycompany.com

ISA EAR

Tool X WAR

Compressed zip

- *Easy startup*
- *Unzip and go*
- *All tools included*
- *No update capabilities*
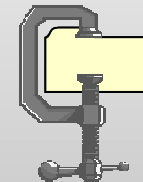
Want ISA to run on z/OS ?

- **There is an RFE open**

    http://www.ibm.com/developerworks/rfe/execute?use_case=viewRfe&CR_ID=74929

- **Go and add comments and 'vote' for it**

Description:	Please add support for the ISA Team Server to run on z/OS
Use case:	Currently have to load ISA Team server to a Linux or Windows server. Would like to run it on z/os WebSphere server
Bookmarkable URL:	http://www.ibm.com/developerworks/rfe/execute?use_case=viewRfe&CR_ID=74929 A unique URL that you can bookmark and share with others.

You have not voted for any requests.

✔ Vote ◄

→ My votes

Voting rules:

- You can only vote once for an individual request.

- You cannot vote for requests that have a "Delivered" status.

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
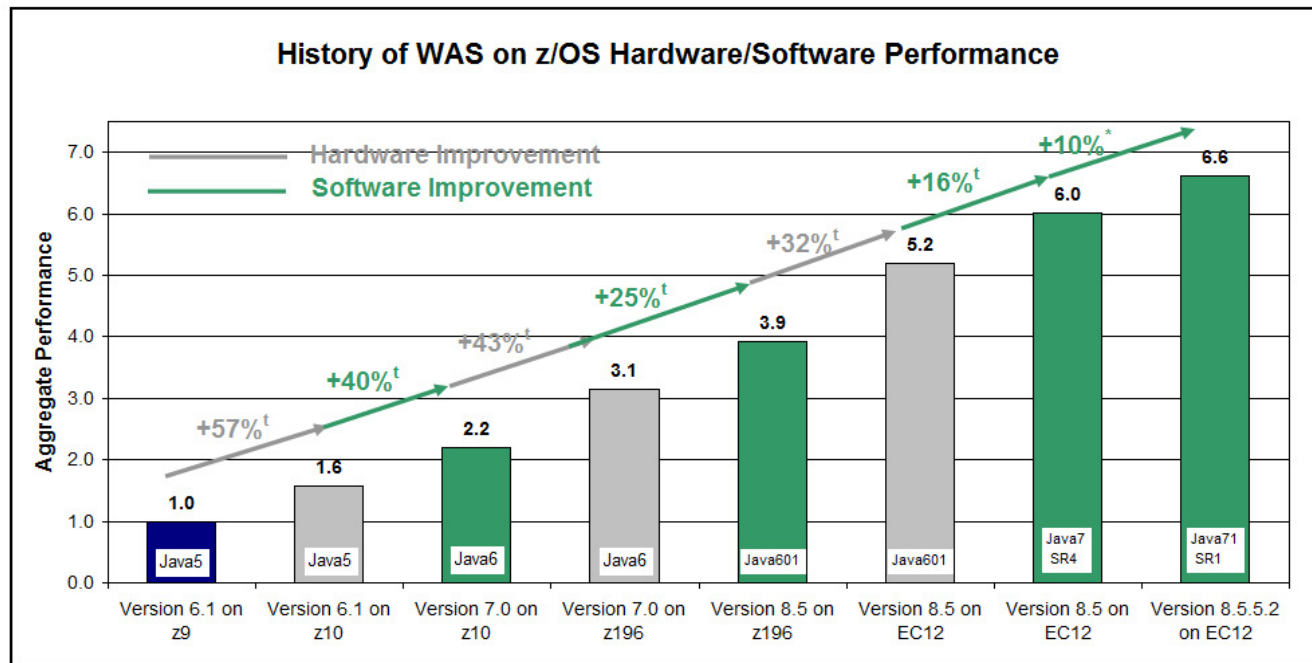- **Enhancements to JZOS Toolkit for Java batch**

Complete your session evaluations online at www.SHARE.org/Orlando-Eval

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

8/9/2015
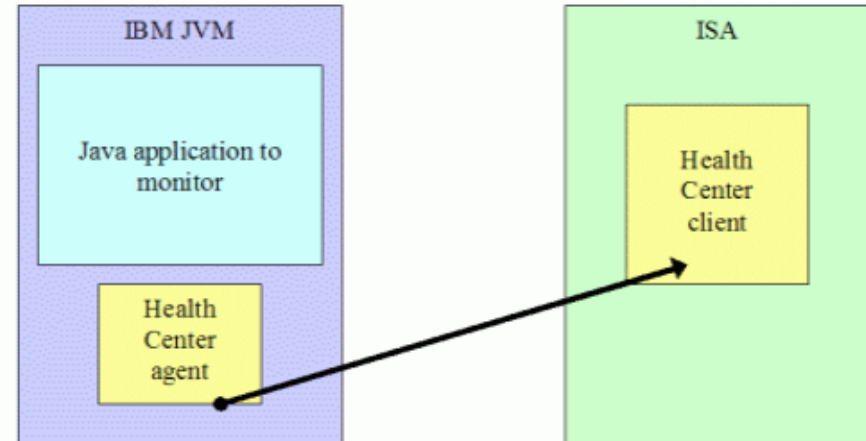(Controlled measurement environment, results may vary)

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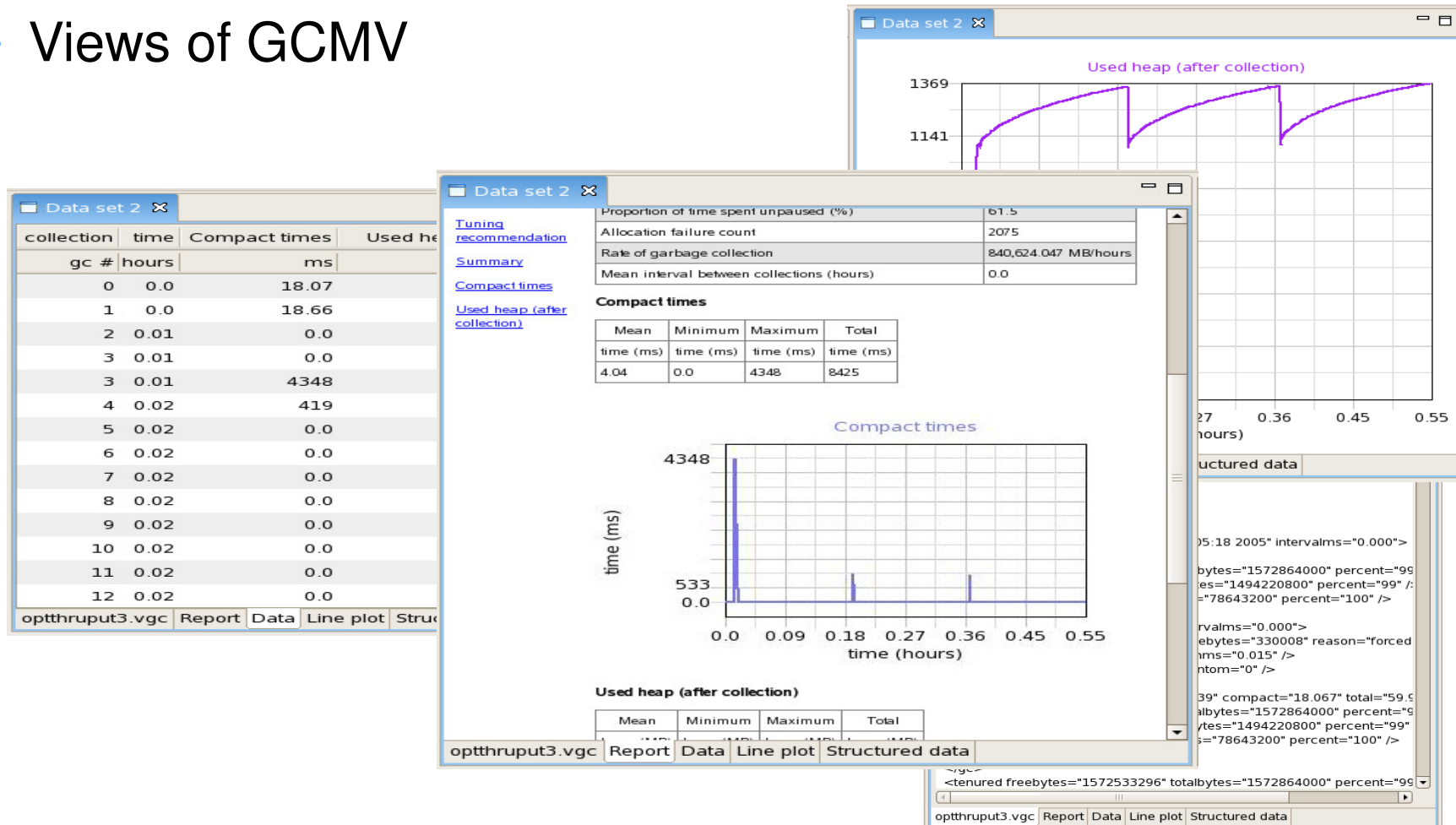
Java Monitoring and Diagnostic Tooling
Garbage Collector and Memory Visualizer (GCMV)

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

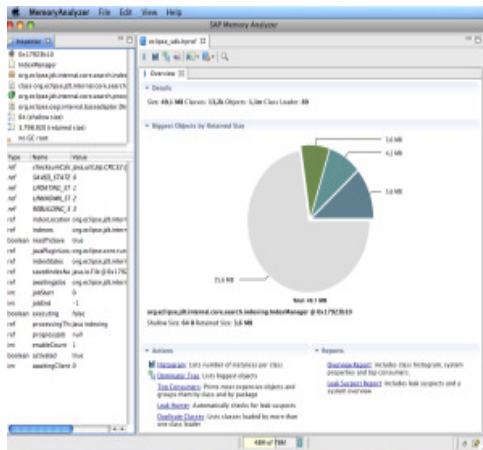Pause times (not including exclusive access)
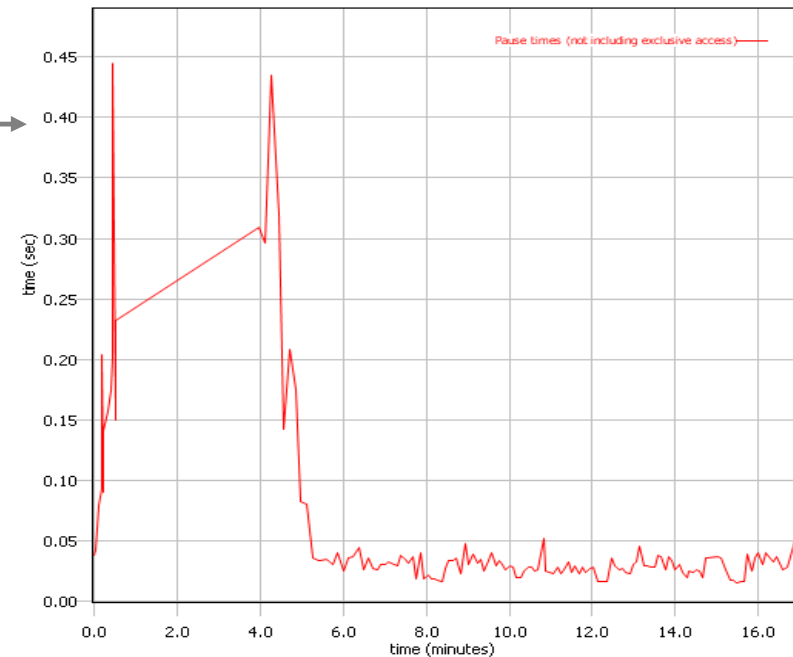
Analysis and Recommendations
- Provides tuning recommendations based on data and flags errors.
- Analysis can be limited using cropping.
- Values and units used in analysis can be changed by changing axes values and units

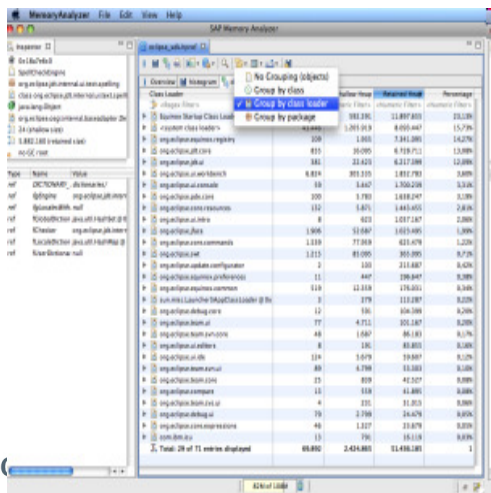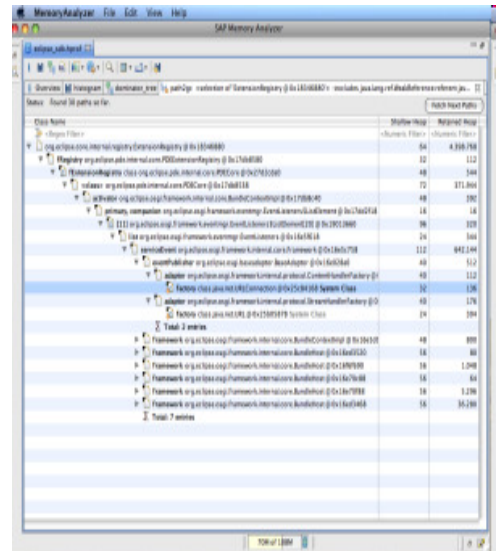# Java Monitoring and Diagnostic Tooling Memory Analyzer

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

https://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/WP101612

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:
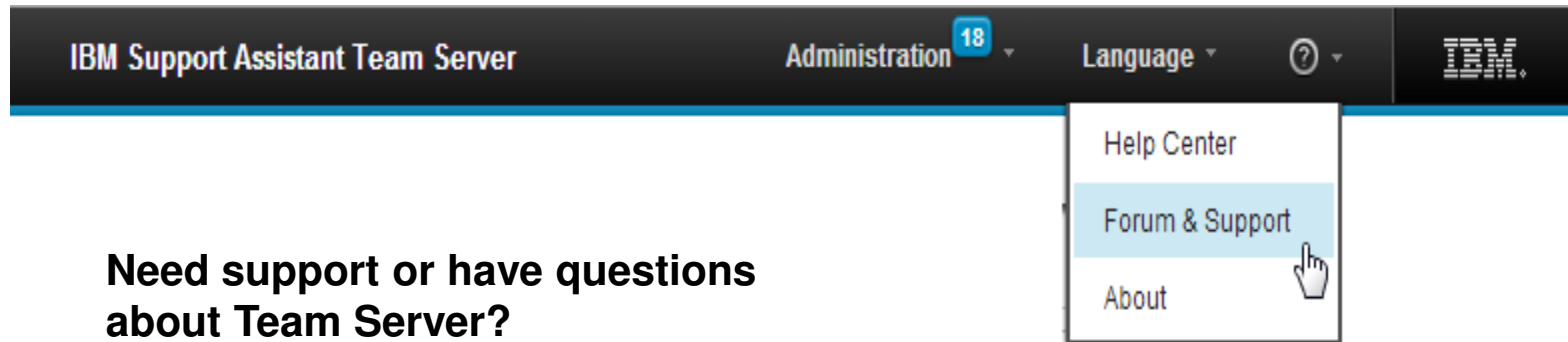 - -Xjit:exclude={java/lang/Math/*}

http://www-01.ibm.com/support/docview.wss?uid=swg21294023

Contact Information

Need support or have questions about Team Server?

Visit our forum:
https://www.ibm.com/developerworks/community/forums/html/forum?id=11111111-0000-0000-0000-000000000935

IBM Support Assistant web page
http://www.ibm.com/software/support/isa

Previous SHARE presentation
Anaheim 2014 Session 14709
Need a Support Assistant ? Check Out IBMs -   ISA
http://www.share.org/p/do/sd/topic=62&sid=9647

Live in ISA 5

(cross fingers here)

WebSphere Application Server Configuration Visualizer

MAT - Memory Analyzer Tool

Health Center