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Virtually Unstoppable

How to diagnose and solve z/OS application issues with APIs and subsystems

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IBM UK LTD

November 2020
Session 3AW

Abstract

- As enterprises depending on IBM Z begin Chapter 2 of their journey to cloud, operations teams are challenged to maintain visibility into increasingly unpredictable workloads, ensuring availability and performance of their subsystems to maintain SLAs and expected qualities of service. With increasing exposure of CICS, IMS and Db2 workloads as RESTful APIs it is critical to be able to monitor these API's, subsystems and the JVMs that link them. Generational shift demands that this visibility be increasingly accessible for less experienced personnel to maintain service levels.

- In this session you will learn how IBM's monitoring solutions, including OMEGAMON for JVM, have been enhanced to give you greater insight into your critical resources, including z/OS Connect EE and how the overall user experience is being enhanced to support generational transition. Join us and learn how customers are leveraging this to drive increased operational resiliency.

Agenda

- Mainframe Monitoring Challenges in Hybrid Multi-Cloud Environment
- Monitoring for hybrid cloud applications with IBM Z OMEGAMON for JVM
  - Typical scenarios
  - Determine z/OS Connect EE API performance
  - Performance improvements
- zTrial – Try for FREE
- Additional Resources – Learn More

Java and z/OS – A natural fit

- Java on z/OS has grown in past 10 years with a mix of new applications and workloads integrating with existing applications

- One of the most popular development languages combined with improved tooling

- Attractive to clients through offloading capabilities on Z

- Performance of Java running on z/OS is second to no other platform

We are living through an API revolution!

Enterprises across every industry are seizing the opportunity to change the way they interact with their customers by unleashing their digital core as part of a hybrid landscape.

The first step of a hybrid journey is to integrate IBM Z through the power of APIs.

APIs on IBM Z are now mainstream!

Integration of Z assets via APIs is seen as the most effective first step on a hybrid journey
Market analysis states 1000s of enterprises will need integration and API enablement on Z in the next few years

z + Z

60%

of enterprises see APIs as critical to their business strategy of integrating Z into their hybrid architecture

1000s

of IBM Z customers will need an API enablement solution in the next few years

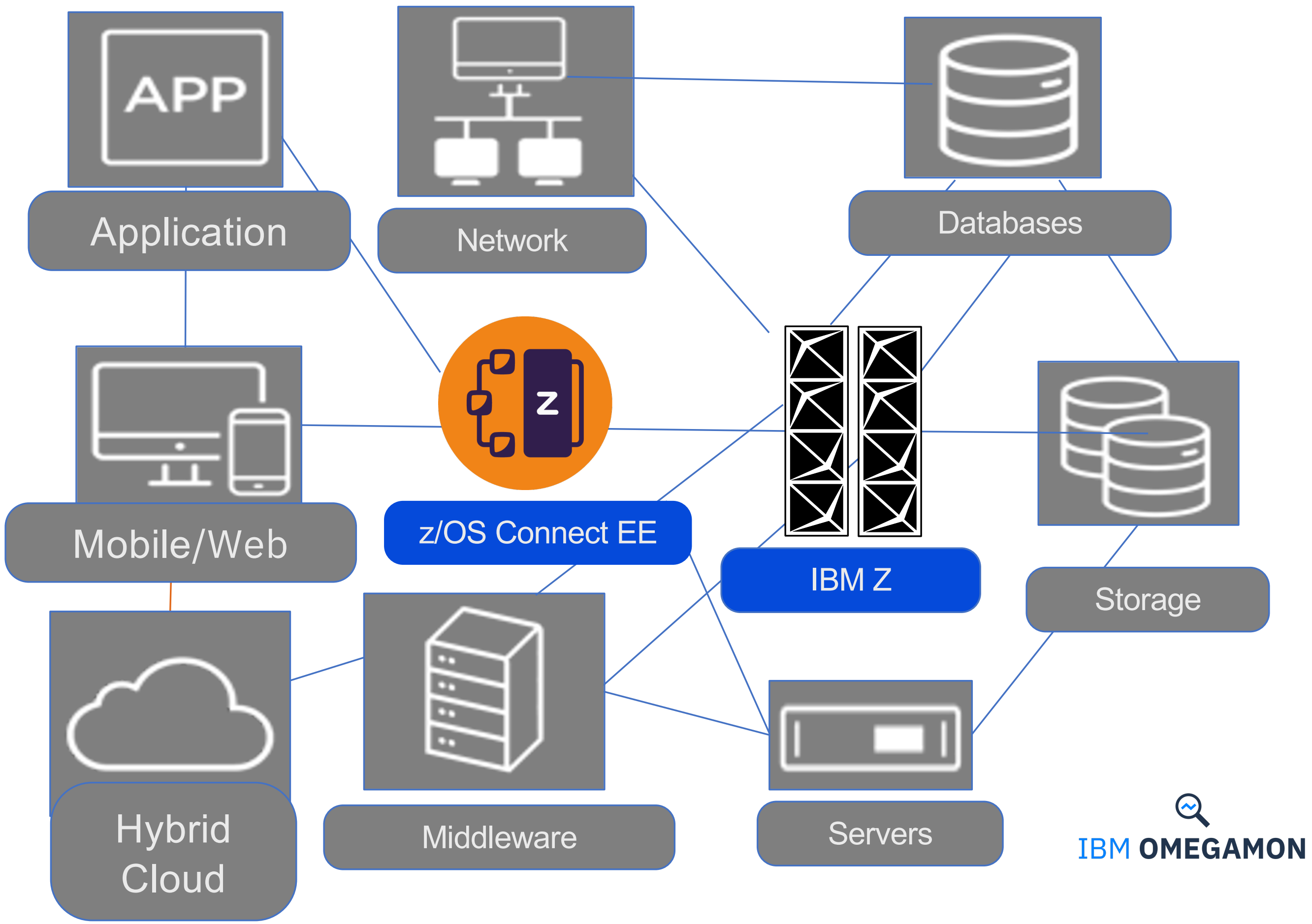
10 of 20

of the world’s top banks already use z/OS Connect Enterprise Edition, and more are on the way

150m

API requests (and counting!) are driven through z/OS Connect Enterprise Edition each day by our largest clients

Monitoring In a Hybrid Cloud Environment



Modern Hybrid Cloud Applications Depend on IBM Z

All IBM Z Resources need to be monitored for Operational Resiliency

JVM’s such as z/OS Connect EE APIs are now business-critical links

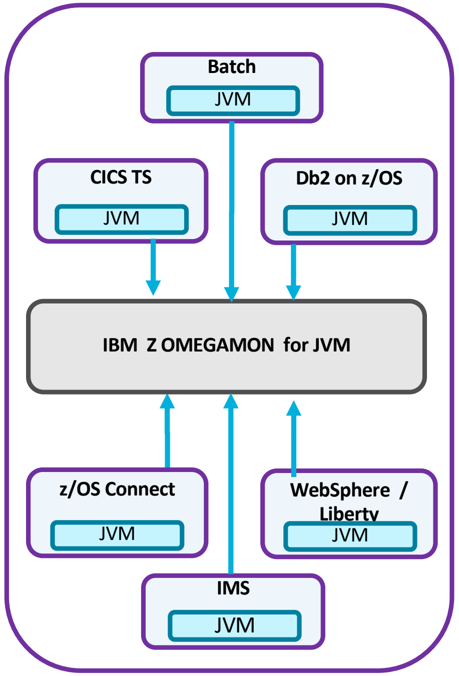
Monitoring of z/OS Connect EE APIs is becoming key to avoiding major blind spots in-between applications, database, and middleware

Monitoring for hybrid cloud applications

IBM Z OMEGAMON for JVM, V5.5
IBM Z OMEGAMON Runtime Edition for JVM, V5.5

IBM Z OMEGAMON for JVM V5.5
IBM Z OMEGAMON Runtime Edition for JVM, V5.5

- identical function, new pricing metric



Reduce Blind Spots by Monitoring all Java Runtimes on z/OS

New!

IBM **OMEGAMON**

Resource monitoring of all online Java Virtual Machines (JVMs) on the z/OS platform

Delivery options:

Standalone / Suites

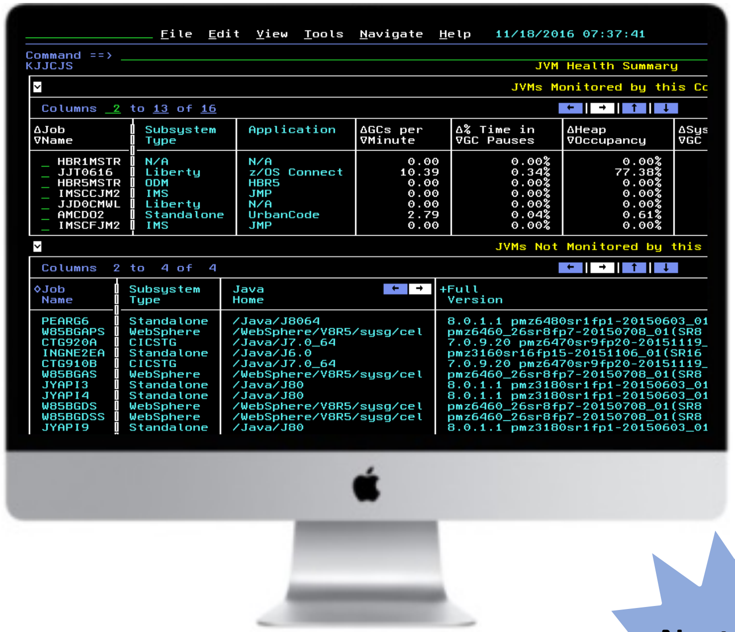
Simultaneous-Instances

- Auto-discover all online JVMs
- Lightweight data collection (no instrumentation)
- At a Glance overview of KPIs affecting z/OS users specifically (zIIPs, Native Memory)
- View all JVMs together side-by-side
- z/OS Connect Enterprise Edition API monitoring

IBM Z OMEGAMON for JVM, V5.5

- New / Updated Features

2019 / 2020 Enhancements



```
___________________ File  Edit  View  Tools  Navigate  Help   11/18/2016 07:37:41
Command ==> ______________________________________________________________________
KJJCJS                                                          JVM Health Summary
                                                       JVMs Monitored by this Cc
 Columns  2 to 13 of 16                                          ← | → | ↑ | ↓
 ΔJob        | Subsystem   | Application  | ΔGCs per | Δ% Time in | ΔHeap      | ΔSys
 ∇Name       | Type        |              | ∇Minute  | ∇GC Pauses | ∇Occupancy | ∇GC
 _  HBR1MSTR | N/A         | N/A          |     0.00 |      0.00% |      0.00% |
 _  JJT0616  | Liberty     | z/OS Connect |    10.39 |      0.34% |     77.38% |
 _  HBR5MSTR | ODM         | HBR5         |     0.00 |      0.00% |      0.00% |
 _  IMSCCJM2 | IMS         | JMP          |     0.00 |      0.00% |      0.00% |
 _  JJD0CMWL | Liberty     | N/A          |     0.00 |      0.00% |      0.00% |
 _  AMCD02   | Standalone  | UrbanCode    |     2.79 |      0.04% |      0.61% |
 _  IMSCFJM2 | IMS         | JMP          |     0.00 |      0.00% |      0.00% |
                                                    JVMs Not Monitored by this
 Columns  2 to  4 of  4                                          ← | → | ↑ | ↓
 ◊Job      | Subsystem  | Java                   ← → | +Full
  Name     | Type       | Home                       |  Version
  PEARG6   | Standalone | /Java/J8064                |  8.0.1.1 pmz6480sr1fp1-20150603_01
  W85BGAPS | WebSphere  | /WebSphere/V8R5/sysg/cel   |  pmz6460_26sr8fp7-20150708_01(SR8
  CTG920A  | CICSTG     | /Java/J7.0_64              |  7.0.9.20 pmz6470sr9fp20-20151119_
  INGNE2EA | Standalone | /Java/J6.0                 |  pmz3160sr16fp15-20151106_01(SR16
  CTG910B  | CICSTG     | /Java/J7.0_64              |  7.0.9.20 pmz6470sr9fp20-20151119_
  W85BGAS  | WebSphere  | /WebSphere/V8R5/sysg/cel   |  pmz6460_26sr8fp7-20150708_01(SR8
  JYAPI3   | Standalone | /Java/J80                  |  8.0.1.1 pmz3180sr1fp1-20150603_01
  JYAPI4   | Standalone | /Java/J80                  |  8.0.1.1 pmz3180sr1fp1-20150603_01
  W85BGDS  | WebSphere  | /WebSphere/V8R5/sysg/cel   |  pmz6460_26sr8fp7-20150708_01(SR8
  W85BGDSS | WebSphere  | /WebSphere/V8R5/sysg/cel   |  pmz6460_26sr8fp7-20150708_01(SR8
  JYAPI9   | Standalone | /Java/J80                  |  8.0.1.1 pmz3180sr1fp1-20150603_01
```

Added since V5.4

1Q 2020

- Advanced Monitoring for z/OS Connect APIs
  - Records every API request
  - API Response Time breakdown
  - View Service provider details
- V5.5 Enhancements
  - Extend native memory details
  - Supplementary API visualization
  - List completed JVM tasks
  - Collector performance improvements
  - New pricing option

Next

- Offering in continuous delivery – further updates planned

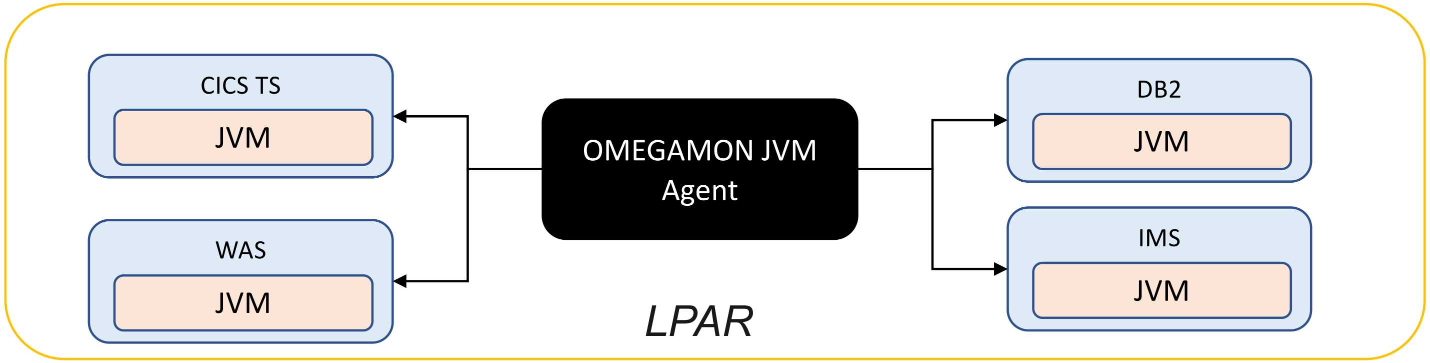
Typical Scenarios for IBM Z OMEGAMON for JVM, V5.5.0

- Understand workloads with visibility and discovery of JVMs
- Monitor for JVM service levels (patched to latest level?)
- Monitor JVM memory usage
- Monitor for NATIVE memory usage
- Monitor Java Garbage Collection
- Determine Performance Issues
  - E.g. Locks / Threads
- Determine z/OS Connect EE API Performance Issues
- Review Performance History

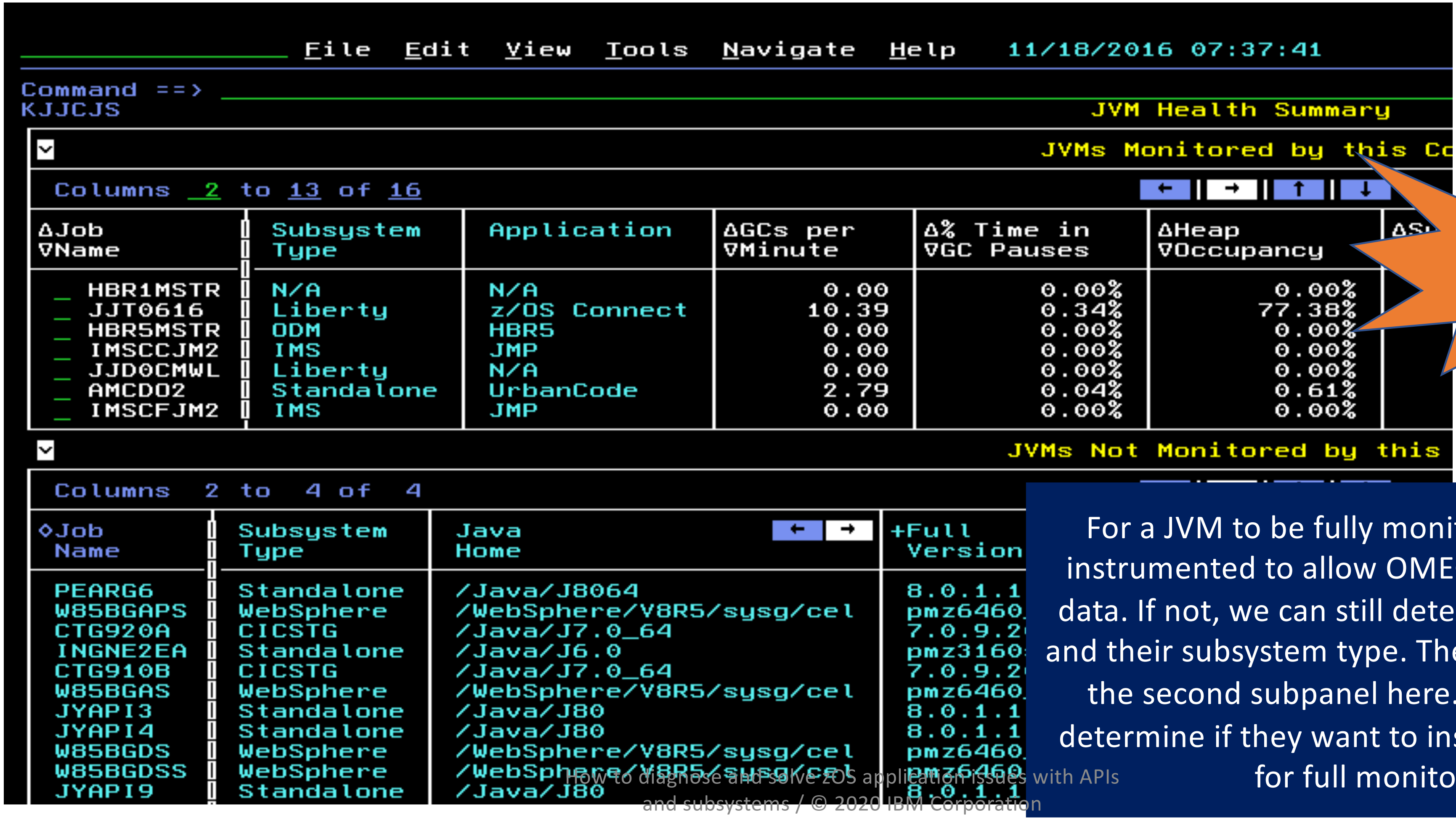
Scenario: Understand workloads with visibility and Discovery of JVMs

How much Java are we running? We need to see all JVMs that are currently online

- JVMs can be found all over the environment. Can you be clear what is online, are there JVMs online that are unplanned?
- Starting the JVM Monitor will seek out and find all JVMs on an LPAR regardless of subsystem type whether they have been configured for full monitoring or not.
- The agent will capture the jobname, ASID, subsystem type and basic details of the JVM.



Scenario: Understand workloads with visibility and Discovery of JVMs

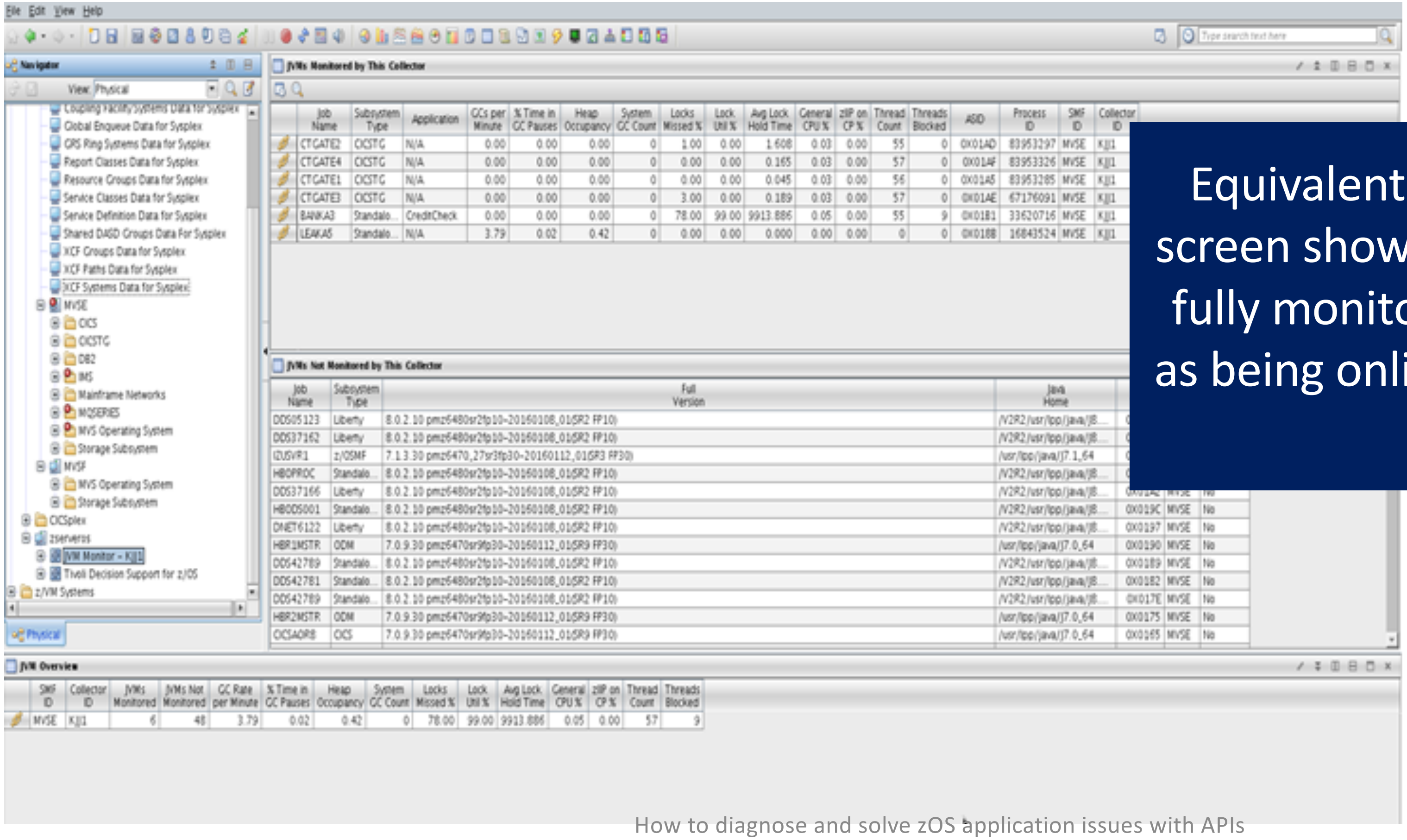


```
                  File  Edit  View  Tools  Navigate  Help    11/18/2016 07:37:41
Command ==>
KJJCJS                                                    JVM Health Summary
                                                     JVMs Monitored by this Co
 Columns  2 to 13 of 16
 ΔJob        Subsystem    Application   ΔGCs per    Δ% Time in   ΔHeap          ΔS
 ∇Name       Type                       ∇Minute     ∇GC Pauses   ∇Occupancy
 _ HBR1MSTR  N/A          N/A                0.00        0.00%         0.00%
 _ JJT0616   Liberty      z/OS Connect      10.39        0.34%        77.38%
 _ HBR5MSTR  ODM          HBR5               0.00        0.00%         0.00%
 _ IMSCCJM2  IMS          JMP                0.00        0.00%         0.00%
 _ JJD0CMWL  Liberty      N/A                0.00        0.00%         0.00%
 _ AMCD02    Standalone   UrbanCode          2.79        0.04%         0.61%
 _ IMSCFJM2  IMS          JMP                0.00        0.00%         0.00%

                                                  JVMs Not Monitored by this
 Columns  2 to  4 of  4
 ◊Job        Subsystem    Java                        +Full
  Name       Type         Home                         Version
  PEARG6     Standalone   /Java/J8064                  8.0.1.1
  W85BGAPS   WebSphere    /WebSphere/V8R5/sysg/cel     pmz6460
  CTG920A    CICSTG       /Java/J7.0_64                7.0.9.2
  INGNE2EA   Standalone   /Java/J6.0                   pmz3160
  CTG910B    CICSTG       /Java/J7.0_64                7.0.9.2
  W85BGAS    WebSphere    /WebSphere/V8R5/sysg/cel     pmz6460
  JYAPI3     Standalone   /Java/J80                    8.0.1.1
  JYAPI4     Standalone   /Java/J80                    8.0.1.1
  W85BGDS    WebSphere    /WebSphere/V8R5/sysg/cel     pmz6460
  W85BGDSS   WebSphere    /WebSphere/V8R5/sysg/cel     pmz6460
  JYAPI9     Standalone   /Java/J80                    8.0.1.1
```

No initial configuration

For a JVM to be fully monitored, it must be instrumented to allow OMEGAMON to collect data. If not, we can still determine online JVMs and their subsystem type. These are reported on the second subpanel here. A user can then determine if they want to instrument that JVM for full monitoring.

Scenario: Understand workloads with visibility and Discovery of JVMs


File Edit View Help
Navigator
View: Physical
Coupling Facility Systems Data for Sysplex
Global Enqueue Data for Sysplex
GRS Ring Systems Data for Sysplex
Report Classes Data for Sysplex
Resource Groups Data for Sysplex
Service Classes Data for Sysplex
Service Definition Data for Sysplex
Shared DASD Groups Data For Sysplex
XCF Groups Data for Sysplex
XCF Paths Data for Sysplex
XCF Systems Data for Sysplex
MVSE
CICS
CICSTG
DB2
IMS
Mainframe Networks
MQSERIES
MVS Operating System
Storage Subsystem
MVSF
MVS Operating System
Storage Subsystem
CICSplex
zservers
JVM Monitor - KJJ1
Tivoli Decision Support for z/OS
z/VM Systems
Physical
Type search text here

JVMs Monitored by This Collector

	Job Name	Subsystem Type	Application	GCs per Minute	% Time in GC Pauses	Heap Occupancy	System GC Count	Locks Missed %	Lock Util %	Avg Lock Hold Time	General CPU %	zIIP on CP %	Thread Count	Threads Blocked	ASID	Process ID	SMF ID	Collector ID
	CTGATE2	CICSTG	N/A	0.00	0.00	0.00	0	1.00	0.00	1.608	0.03	0.00	55	0	0X01AD	83953297	MVSE	KJJ1
	CTGATE4	CICSTG	N/A	0.00	0.00	0.00	0	0.00	0.00	0.165	0.03	0.00	57	0	0X01AF	83953326	MVSE	KJJ1
	CTGATE1	CICSTG	N/A	0.00	0.00	0.00	0	0.00	0.00	0.045	0.03	0.00	56	0	0X01A5	83953285	MVSE	KJJ1
	CTGATE3	CICSTG	N/A	0.00	0.00	0.00	0	3.00	0.00	0.189	0.03	0.00	57	0	0X01AE	67176091	MVSE	KJJ1
	BANKA3	Standalo...	CreditCheck	0.00	0.00	0.00	0	78.00	99.00	9913.886	0.05	0.00	55	9	0X0181	33620716	MVSE	KJJ1
	LEAKA5	Standalo...	N/A	3.79	0.02	0.42	0	0.00	0.00	0.000	0.00	0.00	0	0	0X0188	16843524	MVSE	KJJ1

JVMs Not Monitored by This Collector

Job Name	Subsystem Type	Full Version	Java Home			
DDS05123	Liberty	8.0.2.10 pmz6480sr2fp10-20160108_01(SR2 FP10)	/V2R2/usr/lpp/java/J8...			
DDS37162	Liberty	8.0.2.10 pmz6480sr2fp10-20160108_01(SR2 FP10)	/V2R2/usr/lpp/java/J8...			
IZUSVR1	z/OSMF	7.1.3.30 pmz6470_27sr3fp30-20160112_01(SR3 FP30)	/usr/lpp/java/J7.1_64			
HBOPROC	Standalo...	8.0.2.10 pmz6480sr2fp10-20160108_01(SR2 FP10)	/V2R2/usr/lpp/java/J8...			
DDS37166	Liberty	8.0.2.10 pmz6480sr2fp10-20160108_01(SR2 FP10)	/V2R2/usr/lpp/java/J8...			
HBODS001	Standalo...	8.0.2.10 pmz6480sr2fp10-20160108_01(SR2 FP10)	/V2R2/usr/lpp/java/J8...	0X019C	MVSE	No
DNET6122	Liberty	8.0.2.10 pmz6480sr2fp10-20160108_01(SR2 FP10)	/V2R2/usr/lpp/java/J8...	0X0197	MVSE	No
HBR1MSTR	ODM	7.0.9.30 pmz6470sr9fp30-20160112_01(SR9 FP30)	/usr/lpp/java/J7.0_64	0X0190	MVSE	No
DDS42789	Standalo...	8.0.2.10 pmz6480sr2fp10-20160108_01(SR2 FP10)	/V2R2/usr/lpp/java/J8...	0X0189	MVSE	No
DDS42781	Standalo...	8.0.2.10 pmz6480sr2fp10-20160108_01(SR2 FP10)	/V2R2/usr/lpp/java/J8...	0X0182	MVSE	No
DDS42789	Standalo...	8.0.2.10 pmz6480sr2fp10-20160108_01(SR2 FP10)	/V2R2/usr/lpp/java/J8...	0X017E	MVSE	No
HBR2MSTR	ODM	7.0.9.30 pmz6470sr9fp30-20160112_01(SR9 FP30)	/usr/lpp/java/J7.0_64	0X0175	MVSE	No
CICSAOR8	CICS	7.0.9.30 pmz6470sr9fp30-20160112_01(SR9 FP30)	/usr/lpp/java/J7.0_64	0X0165	MVSE	No

JVM Overview

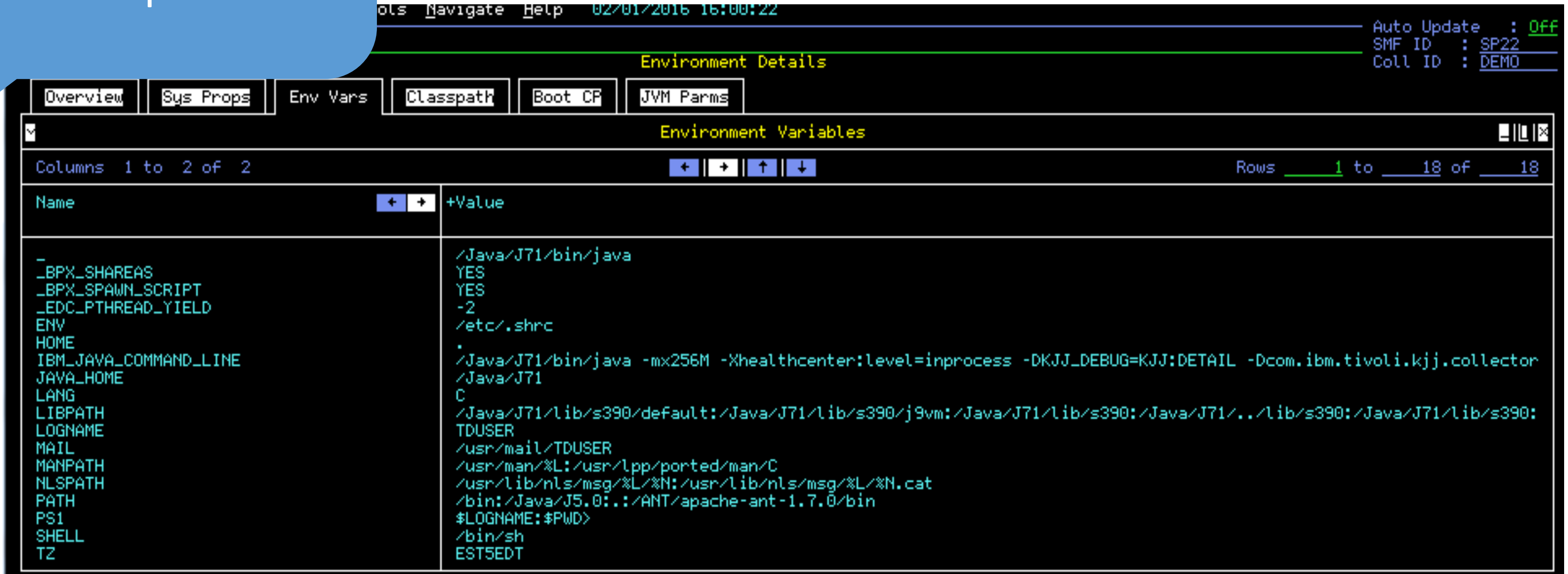
	SMF ID	Collector ID	JVMs Monitored	JVMs Not Monitored	GC Rate per Minute	% Time in GC Pauses	Heap Occupancy	System GC Count	Locks Missed %	Lock Util %	Avg Lock Hold Time	General CPU %	zIIP on CP %	Thread Count	Threads Blocked
	MVSE	KJJ1	6	48	3.79	0.02	0.42	0	78.00	99.00	9913.886	0.05	0.00	57	9

Equivalent Tivoli Enterprise Portal screen showing JVMs currently being fully monitored and those detected as being online but not monitored by JVM agent

Scenario: Monitor for JVM service levels

- Identify Environment Issues

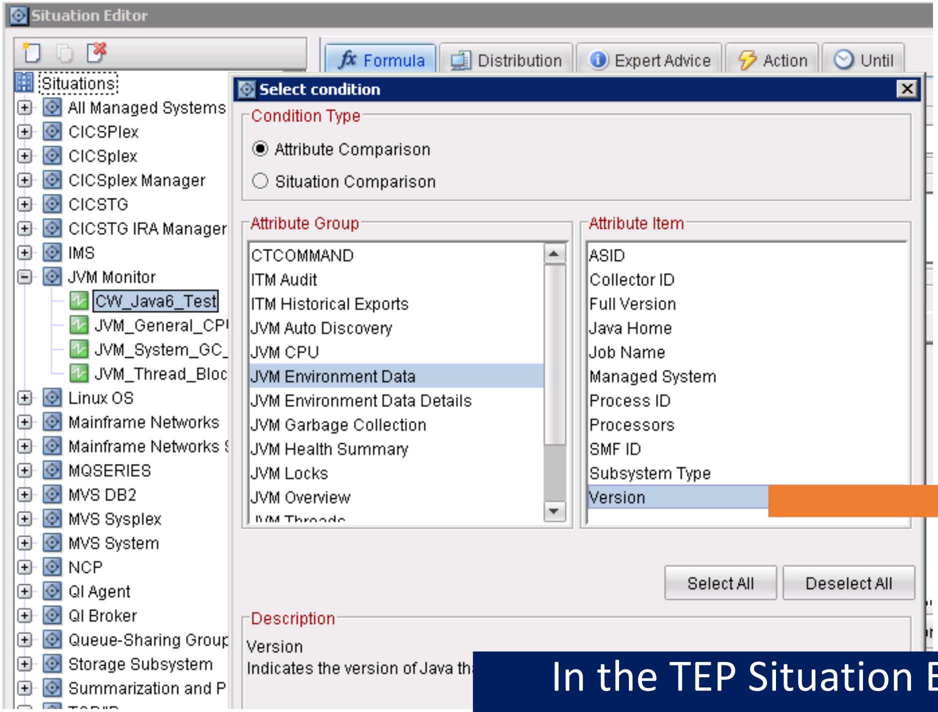
We need to ensure the Java levels being used are up to date and compliant



```
ols  Navigate  Help   02/01/2016 16:00:22
                                                                                  Auto Update   : Off
                                                                                  SMF ID   : SP22
                                    Environment Details                           Coll ID  : DEMO
 Overview | Sys Props | Env Vars | Classpath | Boot CP | JVM Parms
                                    Environment Variables
 Columns  1 to  2 of  2                          ← → ↑ ↓                    Rows    1 to   18 of   18
 Name                              ← →  +Value

 _                                        /Java/J71/bin/java
 _BPX_SHAREAS                             YES
 _BPX_SPAWN_SCRIPT                        YES
 _EDC_PTHREAD_YIELD                       -2
 ENV                                      /etc/.shrc
 HOME                                     .
 IBM_JAVA_COMMAND_LINE                    /Java/J71/bin/java -mx256M -Xhealthcenter:level=inprocess -DKJJ_DEBUG=KJJ:DETAIL -Dcom.ibm.tivoli.kjj.collector
 JAVA_HOME                                /Java/J71
 LANG                                     C
 LIBPATH                                  /Java/J71/lib/s390/default:/Java/J71/lib/s390/j9vm:/Java/J71/lib/s390:/Java/J71/../lib/s390:/Java/J71/lib/s390:
 LOGNAME                                  TDUSER
 MAIL                                     /usr/mail/TDUSER
 MANPATH                                  /usr/man/%L:/usr/lpp/ported/man/C
 NLSPATH                                  /usr/lib/nls/msg/%L/%N:/usr/lib/nls/msg/%L/%N.cat
 PATH                                     /bin:/Java/J5.0:.:/ANT/apache-ant-1.7.0/bin
 PS1                                      $LOGNAME:$PWD>
 SHELL                                    /bin/sh
 TZ                                       EST5EDT
```

Scenario: Monitor for JVM service levels

- Identify Environment Issues



Situation Editor

Formula | Distribution | Expert Advice | Action | Until

Situations
- All Managed Systems
- CICSPlex
- CICSplex
- CICSplex Manager
- CICSTG
- CICSTG IRA Manager
- IMS
- JVM Monitor
  - CW_Java6_Test
  - JVM_General_CPI
  - JVM_System_GC_
  - JVM_Thread_Bloc
- Linux OS
- Mainframe Networks
- Mainframe Networks
- MQSERIES
- MVS DB2
- MVS Sysplex
- MVS System
- NCP
- QI Agent
- QI Broker
- Queue-Sharing Group
- Storage Subsystem
- Summarization and P

Select condition

Condition Type

● Attribute Comparison

○ Situation Comparison

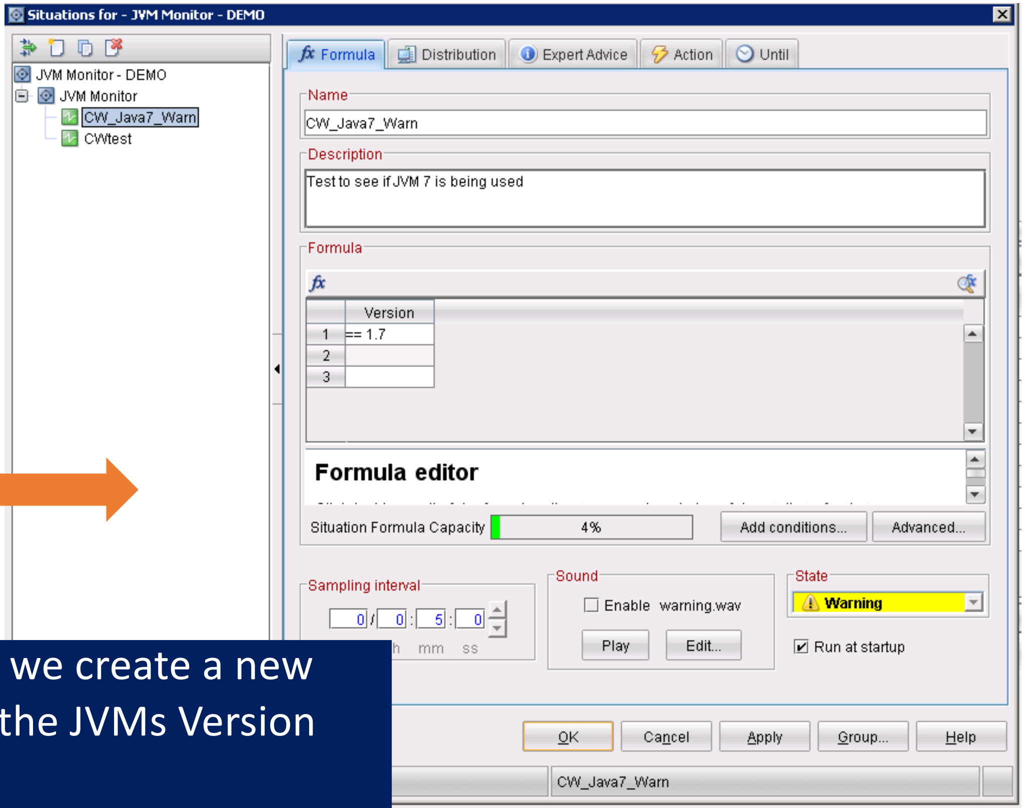
Attribute Group	Attribute Item
CTCOMMAND	ASID
ITM Audit	Collector ID
ITM Historical Exports	Full Version
JVM Auto Discovery	Java Home
JVM CPU	Job Name
JVM Environment Data	Managed System
JVM Environment Data Details	Process ID
JVM Garbage Collection	Processors
JVM Health Summary	SMF ID
JVM Locks	Subsystem Type
JVM Overview	Version

Select All | Deselect All

Description

Version

Indicates the version of Java th



Situations for - JVM Monitor - DEMO

- JVM Monitor - DEMO
  - JVM Monitor
    - CW_Java7_Warn
    - CWtest

Formula | Distribution | Expert Advice | Action | Until

Name: CW_Java7_Warn

Description: Test to see if JVM 7 is being used

Formula

	Version
1	== 1.7
2	
3	

Formula editor

Situation Formula Capacity 4%

Add conditions... | Advanced...

Sampling interval: 0 / 0 : 5 : 0 (h mm ss)

Sound: □ Enable warning.wav — Play | Edit...

State: Warning

☑ Run at startup

OK | Cancel | Apply | Group... | Help

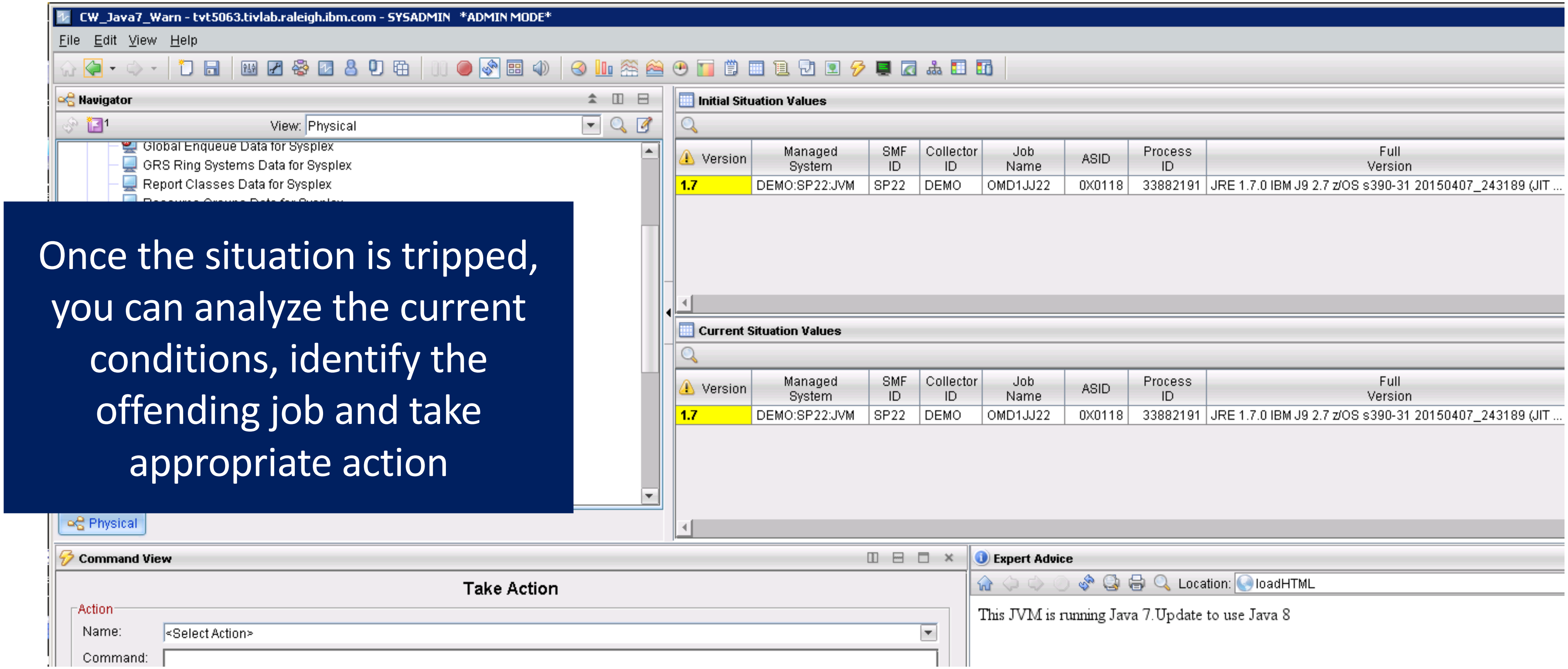
CW_Java7_Warn

In the TEP Situation Editor we create a new Situation to check against the JVMs Version attribute.

If this condition is ever met, a Warning alert will be raised.

Scenario: Monitor for JVM service levels

- Identify Environment Issues



CW_Java7_Warn - tvt5063.tivlab.raleigh.ibm.com - SYSADMIN *ADMIN MODE*
File Edit View Help
Navigator
View: Physical
Global Enqueue Data for Sysplex
GRS Ring Systems Data for Sysplex
Report Classes Data for Sysplex
Physical
Command View

Initial Situation Values

Version	Managed System	SMF ID	Collector ID	Job Name	ASID	Process ID	Full Version
1.7	DEMO:SP22:JVM	SP22	DEMO	OMD1JJ22	0X0118	33882191	JRE 1.7.0 IBM J9 2.7 z/OS s390-31 20150407_243189 (JIT ...

Current Situation Values

Version	Managed System	SMF ID	Collector ID	Job Name	ASID	Process ID	Full Version
1.7	DEMO:SP22:JVM	SP22	DEMO	OMD1JJ22	0X0118	33882191	JRE 1.7.0 IBM J9 2.7 z/OS s390-31 20150407_243189 (JIT ...

Take Action

Action

Name: <Select Action>

Command:

Expert Advice

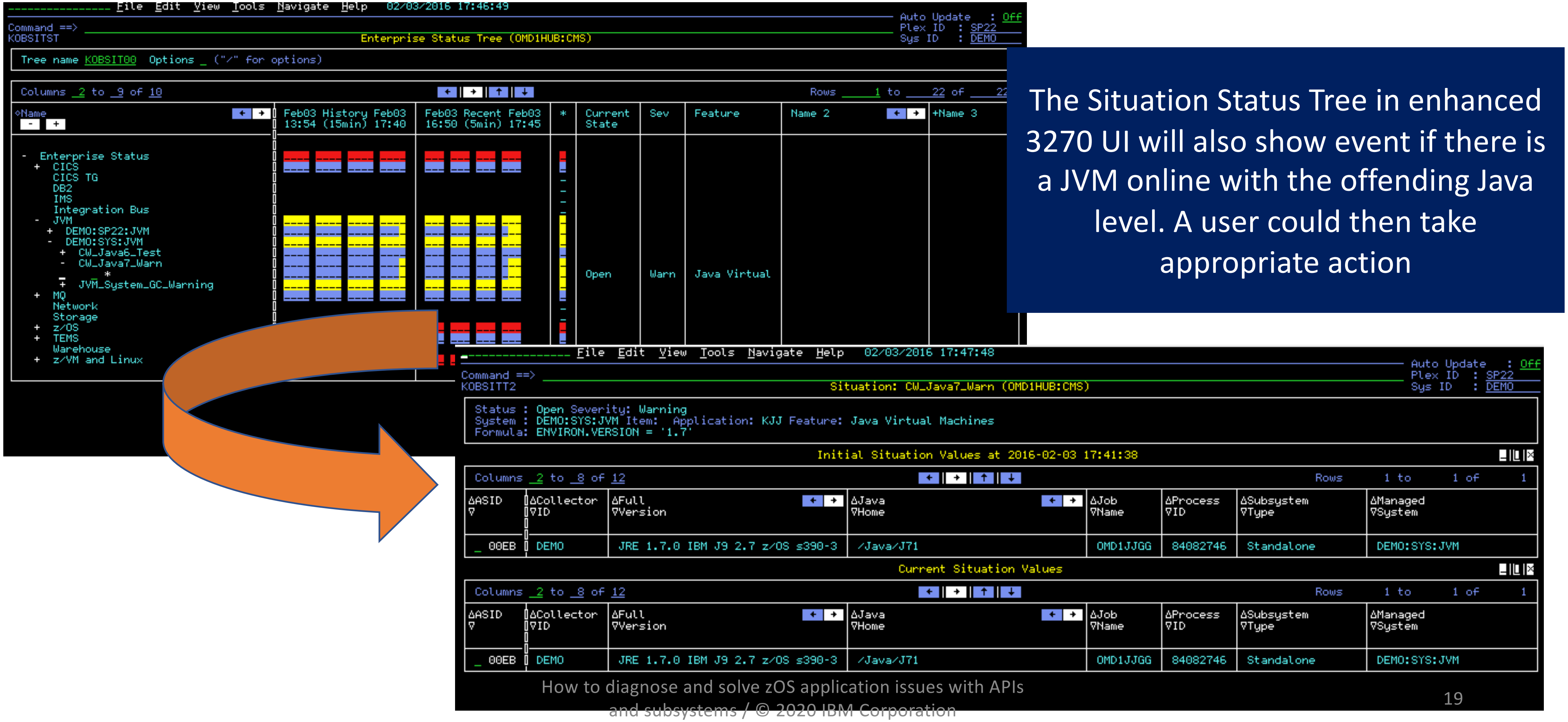
Location: loadHTML

This JVM is running Java 7.Update to use Java 8

Once the situation is tripped, you can analyze the current conditions, identify the offending job and take appropriate action

Scenario: Monitor for JVM service levels

- Identify Environment Issues



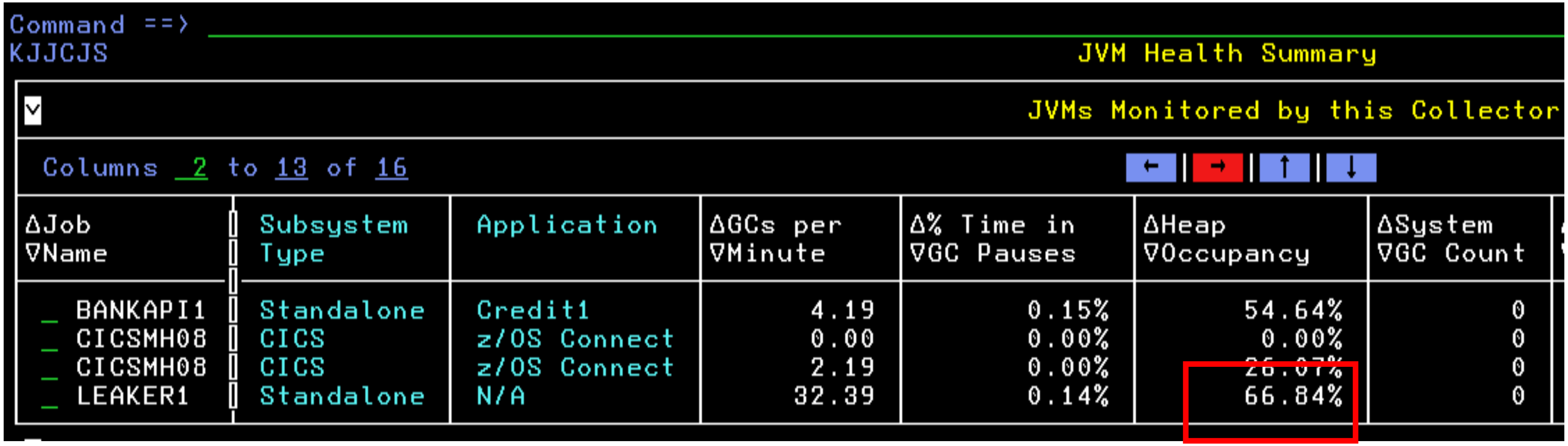
```
________________ File  Edit  View  Tools  Navigate  Help   02/03/2016 17:46:49
                                                                        Auto Update   : Off
Command ==>                                                             Plex ID  : SP22
KOBSITST                     Enterprise Status Tree (OMD1HUB:CMS)       Sys ID   : DEMO

 Tree name KOBSIT00  Options _ ("/" for options)

 Columns _2 to _9 of 10                                        Rows ____1 to ___22 of ___22
◇Name                     Feb03 History Feb03  Feb03 Recent Feb03  *  Current  Sev   Feature        Name 2       +Name 3
 -  +                     13:54 (15min) 17:40  16:50 (5min) 17:45     State

 -  Enterprise Status
   +  CICS
      CICS TG
      DB2
      IMS
      Integration Bus
   -  JVM
     +  DEMO:SP22:JVM
     -  DEMO:SYS:JVM
       +  CW_Java6_Test
       -  CW_Java7_Warn
               *
       +  JVM_System_GC_Warning                                             Open     Warn  Java Virtual
   +  MQ
      Network
      Storage
   +  z/OS
   +  TEMS
      Warehouse
   +  z/VM and Linux
```

```
________________ File  Edit  View  Tools  Navigate  Help   02/03/2016 17:47:48
                                                                        Auto Update   : Off
Command ==>                                                             Plex ID  : SP22
KOBSITT2                     Situation: CW_Java7_Warn (OMD1HUB:CMS)     Sys ID   : DEMO

 Status : Open Severity: Warning
 System : DEMO:SYS:JVM Item:  Application: KJJ Feature: Java Virtual Machines
 Formula: ENVIRON.VERSION = '1.7'

                     Initial Situation Values at 2016-02-03 17:41:38
 Columns _2 to _8 of 12                                              Rows    1 to    1 of    1
 ΔASID  ΔCollector ΔFull                       ΔJava      ΔJob      ΔProcess  ΔSubsystem  ΔManaged
 ∇      ∇ID        ∇Version                    ∇Home      ∇Name     ∇ID       ∇Type       ∇System

 _ 00EB  DEMO      JRE 1.7.0 IBM J9 2.7 z/OS s390-3  /Java/J71  OMD1JJGG  84082746  Standalone  DEMO:SYS:JVM

                     Current Situation Values
 Columns _2 to _8 of 12                                              Rows    1 to    1 of    1
 ΔASID  ΔCollector ΔFull                       ΔJava      ΔJob      ΔProcess  ΔSubsystem  ΔManaged
 ∇      ∇ID        ∇Version                    ∇Home      ∇Name     ∇ID       ∇Type       ∇System

 _ 00EB  DEMO      JRE 1.7.0 IBM J9 2.7 z/OS s390-3  /Java/J71  OMD1JJGG  84082746  Standalone  DEMO:SYS:JVM
```

The Situation Status Tree in enhanced 3270 UI will also show event if there is a JVM online with the offending Java level. A user could then take appropriate action

Scenario: Monitor JVM memory usage

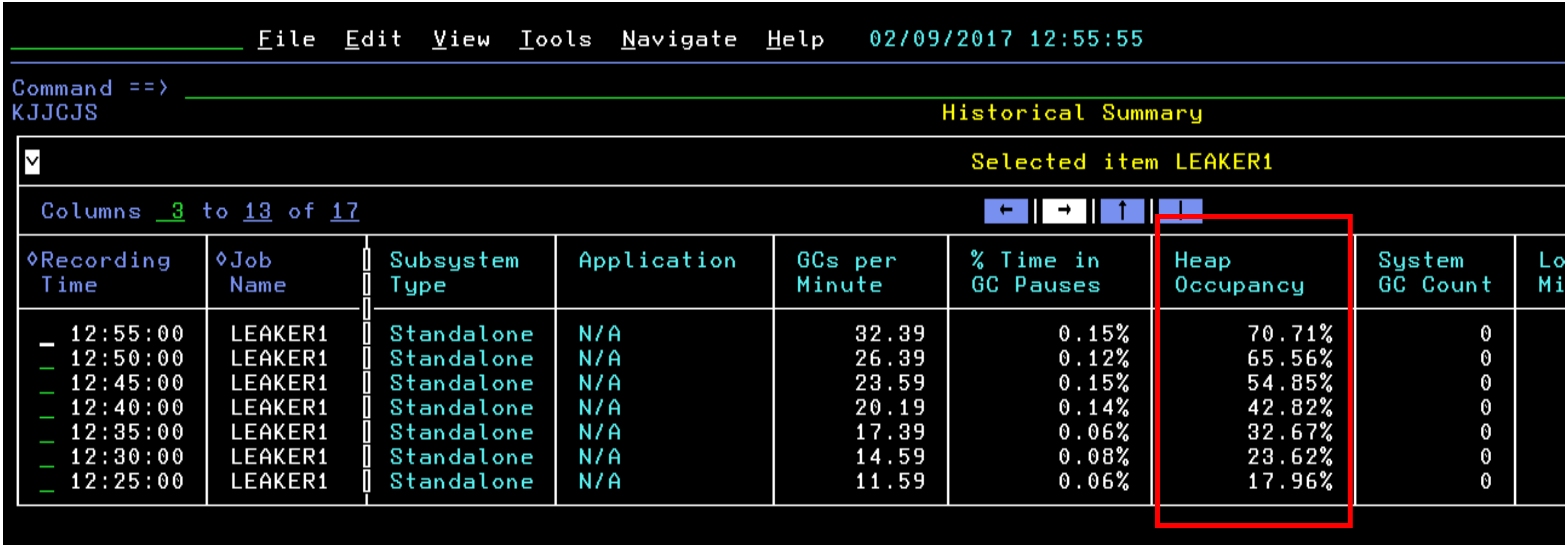
- JVM Heap Memory Management



```
Command ==> ________________________________________________________________
KJJCJS                                              JVM Health Summary

 ☑                                        JVMs Monitored by this Collector

  Columns _2 to 13 of 16                                    ← | → | ↑ | ↓

 ΔJob        | Subsystem  | Application  | ΔGCs per | Δ% Time in | ΔHeap      | ΔSystem
 ∇Name       | Type       |              | ∇Minute  | ∇GC Pauses | ∇Occupancy | ∇GC Count

 _ BANKAPI1  | Standalone | Credit1      |     4.19 |      0.15% |     54.64% |        0
 _ CICSMH08  | CICS       | z/OS Connect |     0.00 |      0.00% |      0.00% |        0
 _ CICSMH08  | CICS       | z/OS Connect |     2.19 |      0.00% |     26.07% |        0
 _ LEAKER1   | Standalone | N/A          |    32.39 |      0.14% |     66.84% |        0
```

Scenario: Monitor JVM memory usage

- JVM Heap Memory Management

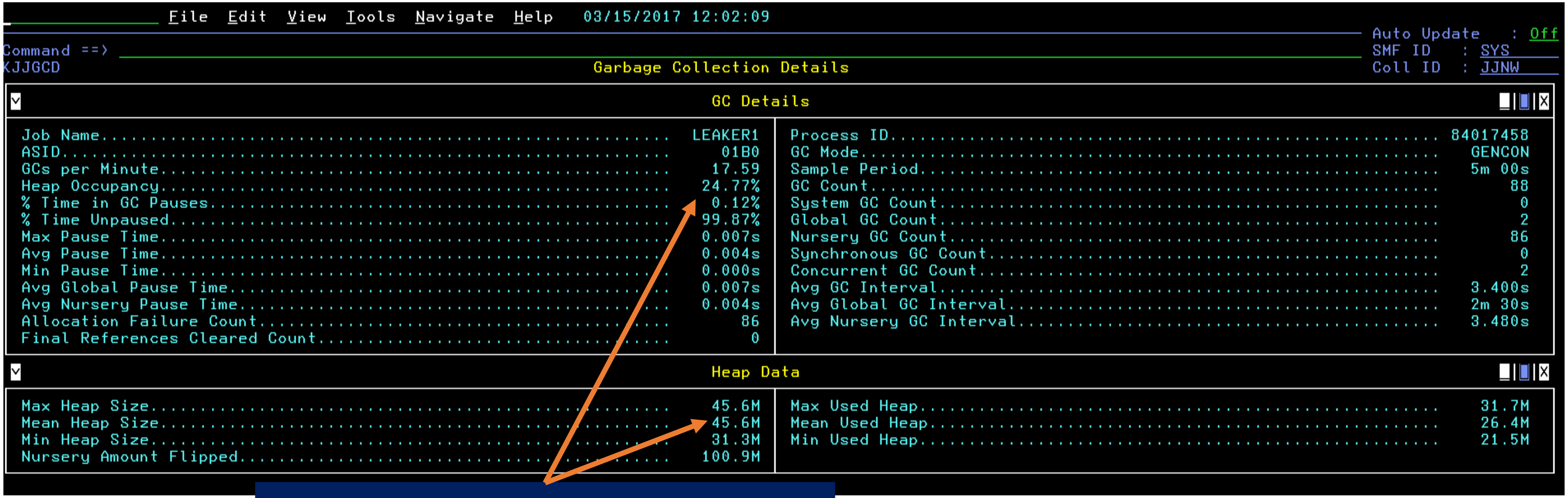


```
02/09/2017 12:55:55
Command ==>
KJJCJS                                   Historical Summary
                                         Selected item LEAKER1
Columns  3 to 13 of 17
```

◊Recording Time	◊Job Name	Subsystem Type	Application	GCs per Minute	% Time in GC Pauses	Heap Occupancy	System GC Count	Lo Mi
12:55:00	LEAKER1	Standalone	N/A	32.39	0.15%	70.71%	0	
12:50:00	LEAKER1	Standalone	N/A	26.39	0.12%	65.56%	0	
12:45:00	LEAKER1	Standalone	N/A	23.59	0.15%	54.85%	0	
12:40:00	LEAKER1	Standalone	N/A	20.19	0.14%	42.82%	0	
12:35:00	LEAKER1	Standalone	N/A	17.39	0.06%	32.67%	0	
12:30:00	LEAKER1	Standalone	N/A	14.59	0.08%	23.62%	0	
12:25:00	LEAKER1	Standalone	N/A	11.59	0.06%	17.96%	0	

Scenario: Monitor JVM memory usage

- JVM Heap Memory Management

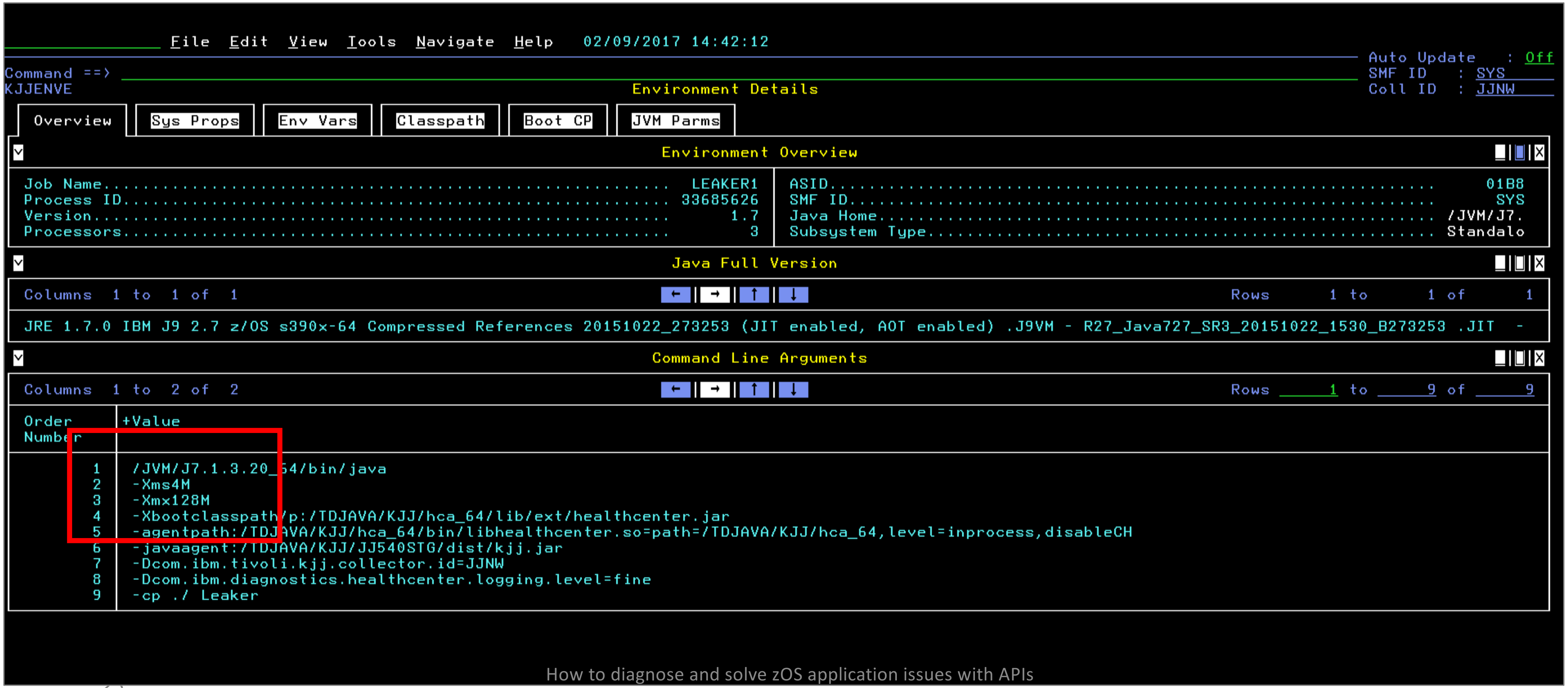


```
_              File  Edit  View  Tools  Navigate  Help   03/15/2017 12:02:09
                                                                                     Auto Update    : Off
Command ==> ____________________________________________________________________     SMF ID    : SYS
KJJGCD                               Garbage Collection Details                      Coll ID   : JJNW

                                          GC Details
 Job Name.............................................  LEAKER1   Process ID.................................................  84017458
 ASID.................................................     01B0   GC Mode....................................................    GENCON
 GCs per Minute.......................................    17.59   Sample Period..............................................   5m 00s
 Heap Occupancy.......................................   24.77%   GC Count...................................................        88
 % Time in GC Pauses..................................    0.12%   System GC Count............................................         0
 % Time Unpaused......................................   99.87%   Global GC Count............................................         2
 Max Pause Time.......................................   0.007s   Nursery GC Count...........................................        86
 Avg Pause Time.......................................   0.004s   Synchronous GC Count.......................................         0
 Min Pause Time.......................................   0.000s   Concurrent GC Count........................................         2
 Avg Global Pause Time................................   0.007s   Avg GC Interval............................................    3.400s
 Avg Nursery Pause Time...............................   0.004s   Avg Global GC Interval.....................................   2m 30s
 Allocation Failure Count.............................       86   Avg Nursery GC Interval....................................    3.480s
 Final References Cleared Count.......................        0

                                          Heap Data
 Max Heap Size........................................    45.6M   Max Used Heap..............................................     31.7M
 Mean Heap Size.......................................    45.6M   Mean Used Heap.............................................     26.4M
 Min Heap Size........................................    31.3M   Min Used Heap..............................................     21.5M
 Nursery Amount Flipped...............................   100.9M
```

Does the Occupancy look OK?
Average Heap size fine?

Scenario: Monitor JVM memory usage

- JVM Heap Memory Management



```
            File  Edit  View  Tools  Navigate  Help   02/09/2017 14:42:12
                                                                                          Auto Update    : Off
Command ==>                                                                               SMF ID     : SYS
KJJENVE                                     Environment Details                           Coll ID    : JJNW
  Overview   Sys Props   Env Vars   Classpath   Boot CP   JVM Parms
                                             Environment Overview
  Job Name.......................................................... LEAKER1 | ASID...................................................... 01B8
  Process ID........................................................ 33685626 | SMF ID.................................................... SYS
  Version........................................................... 1.7 | Java Home.................................................. /JVM/J7.
  Processors........................................................ 3 | Subsystem Type............................................. Standalo
                                              Java Full Version
  Columns  1 to  1 of  1                                                               Rows      1 to      1 of      1
  JRE 1.7.0 IBM J9 2.7 z/OS s390x-64 Compressed References 20151022_273253 (JIT enabled, AOT enabled) .J9VM - R27_Java727_SR3_20151022_1530_B273253 .JIT  -
                                            Command Line Arguments
  Columns  1 to  2 of  2                                                               Rows      1 to      9 of      9
  Order     +Value
  Number
         1   /JVM/J7.1.3.20_64/bin/java
         2   -Xms4M
         3   -Xmx128M
         4   -Xbootclasspath/p:/TDJAVA/KJJ/hca_64/lib/ext/healthcenter.jar
         5   -agentpath:/TDJAVA/KJJ/hca_64/bin/libhealthcenter.so=path=/TDJAVA/KJJ/hca_64,level=inprocess,disableCH
         6   -javaagent:/TDJAVA/KJJ/JJ540STG/dist/kjj.jar
         7   -Dcom.ibm.tivoli.kjj.collector.id=JJNW
         8   -Dcom.ibm.diagnostics.healthcenter.logging.level=fine
         9   -cp ./ Leaker
```

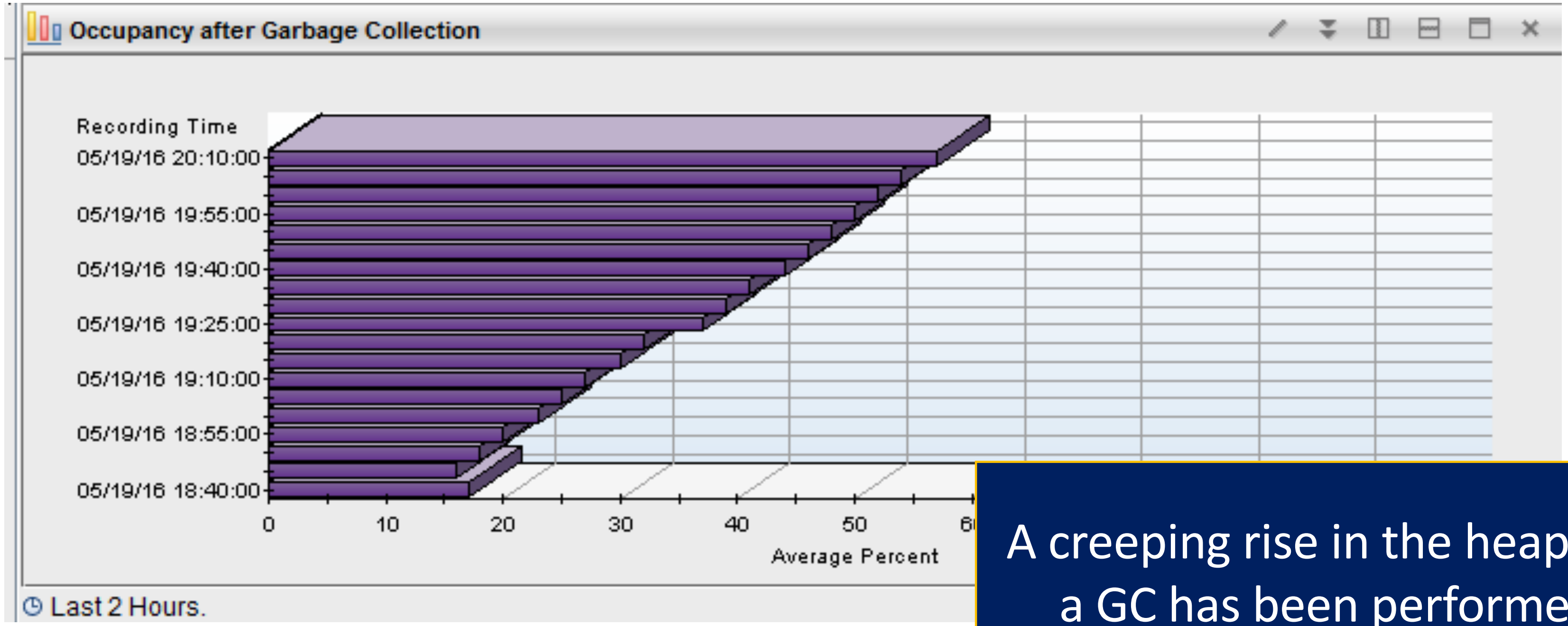
Scenario: Monitor JVM memory usage

- JVM Heap Memory Management

The Maximum Heap Size (-Xmx) is insufficient for this JVM for the Workload. We can increase this to give the Java Heap increased capacity

We should also be wary of a memory leak in this application if issues persist

Scenario: Monitor JVM memory usage
- JVM Heap Memory Management

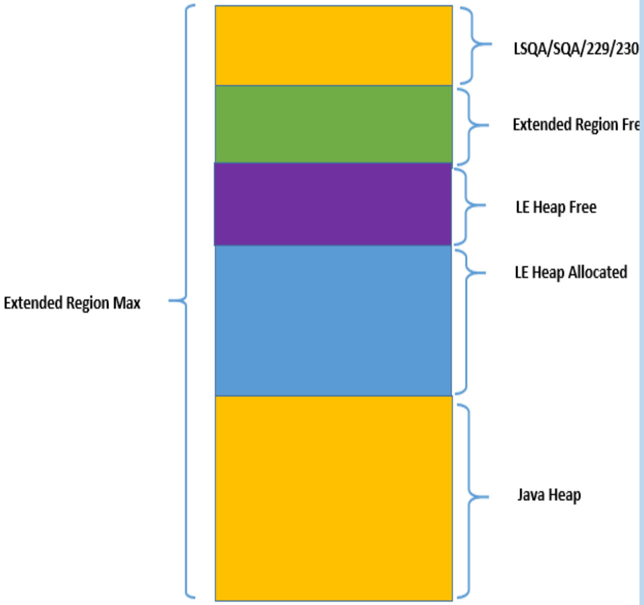


A creeping rise in the heap occupancy after a GC has been performed is a sign of a possible memory leak. Unaddressed could lead to Out Of Memory Error and JVM abend and core dump

Scenario: Monitor for NATIVE memory usage

- Additional Native Memory Monitoring

Figure 1. Extended Region Memory Allocation

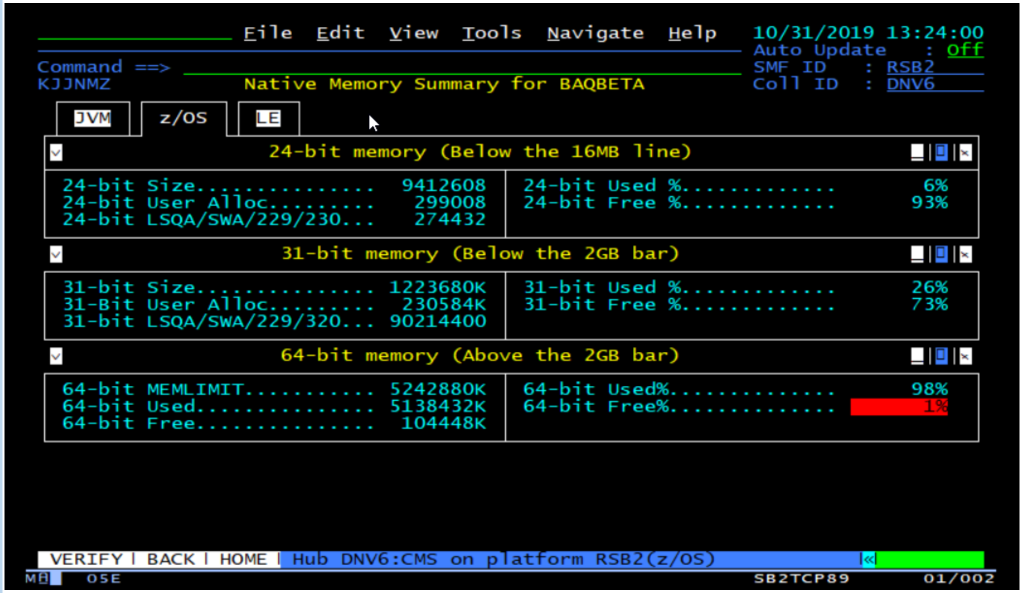


Native Memory is critical –JVM heap size can only increase to the limit of Native Memory available

New - Added 24- and 64-bit memory monitoring

New Product-Provided Situations for native memory

Avoiding Native OutOfMemoryError



```
                    File  Edit  View  Tools  Navigate  Help   10/31/2019 13:24:00
                                                               Auto Update    : Off
Command ==>                                                    SMF ID    : RSB2
KJJNMZ              Native Memory Summary for BAQBETA          Coll ID   : DNV6
 JVM   z/OS   LE
         24-bit memory (Below the 16MB line)
 24-bit Size.............. 9412608   24-bit Used %............     6%
 24-bit User Alloc.........  299008   24-bit Free %............    93%
 24-bit LSQA/SWA/229/230...  274432
          31-bit memory (Below the 2GB bar)
 31-bit Size.............. 1223680K  31-bit Used %............    26%
 31-Bit User Alloc.........  230584K  31-bit Free %............    73%
 31-bit LSQA/SWA/229/320... 90214400
          64-bit memory (Above the 2GB bar)
 64-bit MEMLIMIT........... 5242880K  64-bit Used%.............    98%
 64-bit Used............... 5138432K  64-bit Free%.............     1%
 64-bit Free...............  104448K

 VERIFY | BACK | HOME | Hub DNV6:CMS on platform RSB2(z/OS)
MB     05E                                            SB2TCP89      01/002
```

Scenario: Monitor Java Garbage Collection

Performance of JVM is poor. What can be causing this?

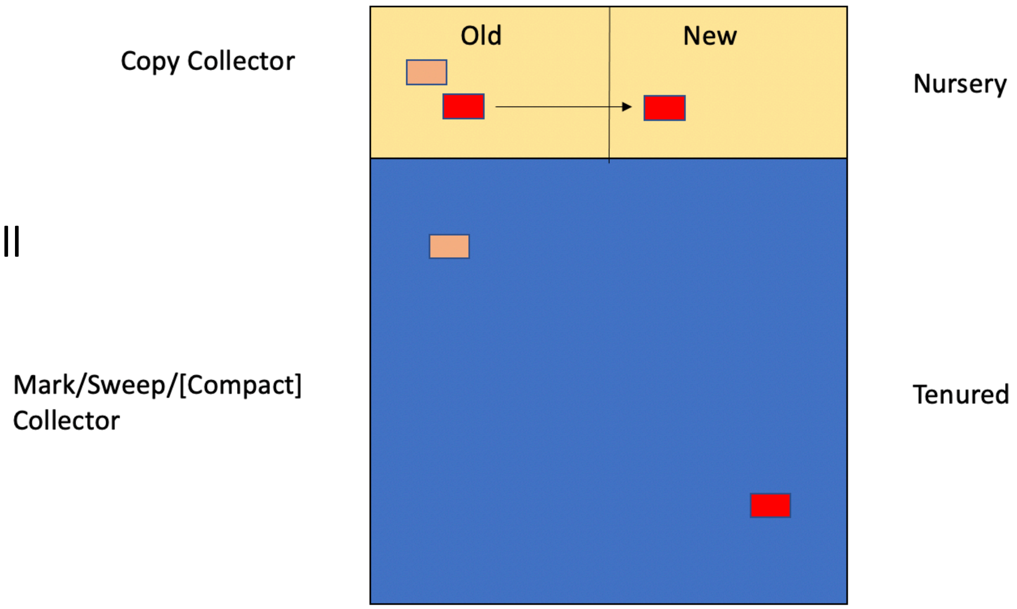
- Performance of the Garbage Collector has improved significantly in recent releases of Java however poor performance can still occur due to:
  - Insufficient heap allocation
  - Poorly written applications
- The symptoms of such problems might be:
  - Excessive number GC events occurring within a given period of time
  - High heap occupancy even after a GC
  - Long pause times when GC event is occurring
  - System GC events occurring

Scenario: Monitor Java Garbage Collection

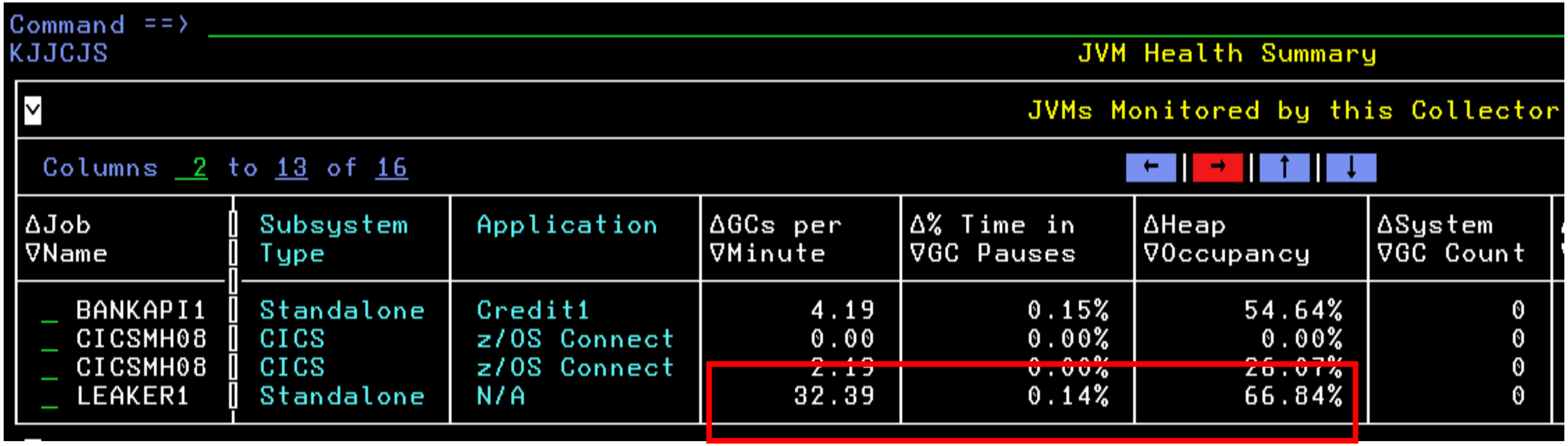
- What is “Garbage Collection”?
  - Removal of unreferenced objects
  - Occurs under two conditions:

    Object Allocation Failure

    Programmatically requested by System.gc() call
- Four different collection algorithms or “policies”
  - optthruput
  - optavgpause
  - gencon
  - balanced

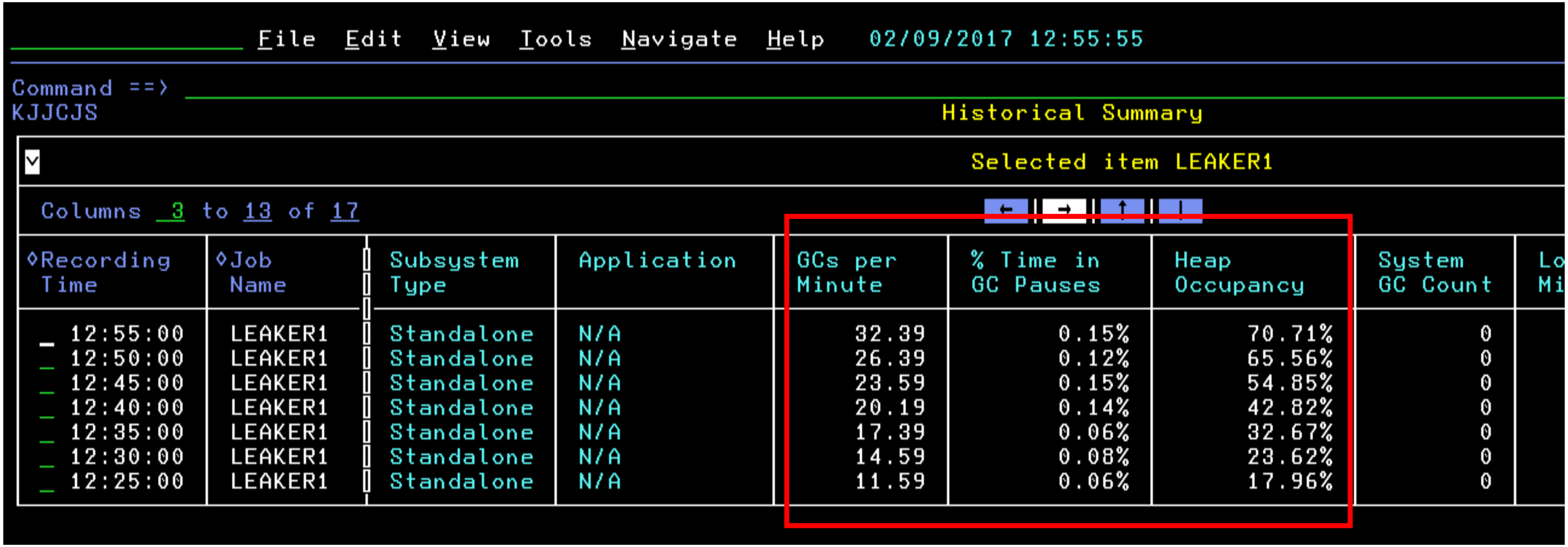


Scenario: Monitor Java Garbage Collection



```
Command ==>
KJJCJS                                   JVM Health Summary

 ▽                                        JVMs Monitored by this Collector

  Columns _2 to 13 of 16                                   ← | → | ↑ | ↓

 ΔJob         Subsystem    Application   ΔGCs per    Δ% Time in   ΔHeap        ΔSystem
 ∇Name        Type                       ∇Minute     ∇GC Pauses   ∇Occupancy   ∇GC Count

 _ BANKAPI1   Standalone   Credit1           4.19        0.15%       54.64%          0
 _ CICSMH08   CICS         z/OS Connect      0.00        0.00%        0.00%          0
 _ CICSMH08   CICS         z/OS Connect      2.19        0.00%       26.07%          0
 _ LEAKER1    Standalone   N/A              32.39        0.14%       66.84%          0
```

Scenario: Monitor Java Garbage Collection



```
 ______________  File  Edit  View  Tools  Navigate  Help    02/09/2017 12:55:55
Command ==> ____________________________________________________________________
KJJCJS                                        Historical Summary
                                              Selected item LEAKER1
  Columns  3 to 13 of 17
◊Recording  ◊Job      Subsystem   Application   GCs per   % Time in   Heap        System    Lo
 Time        Name     Type                      Minute    GC Pauses   Occupancy   GC Count  Mi
_ 12:55:00  LEAKER1   Standalone  N/A            32.39       0.15%      70.71%          0
_ 12:50:00  LEAKER1   Standalone  N/A            26.39       0.12%      65.56%          0
_ 12:45:00  LEAKER1   Standalone  N/A            23.59       0.15%      54.85%          0
_ 12:40:00  LEAKER1   Standalone  N/A            20.19       0.14%      42.82%          0
_ 12:35:00  LEAKER1   Standalone  N/A            17.39       0.06%      32.67%          0
_ 12:30:00  LEAKER1   Standalone  N/A            14.59       0.08%      23.62%          0
_ 12:25:00  LEAKER1   Standalone  N/A            11.59       0.06%      17.96%          0
```

Scenario: Determine Performance Issues

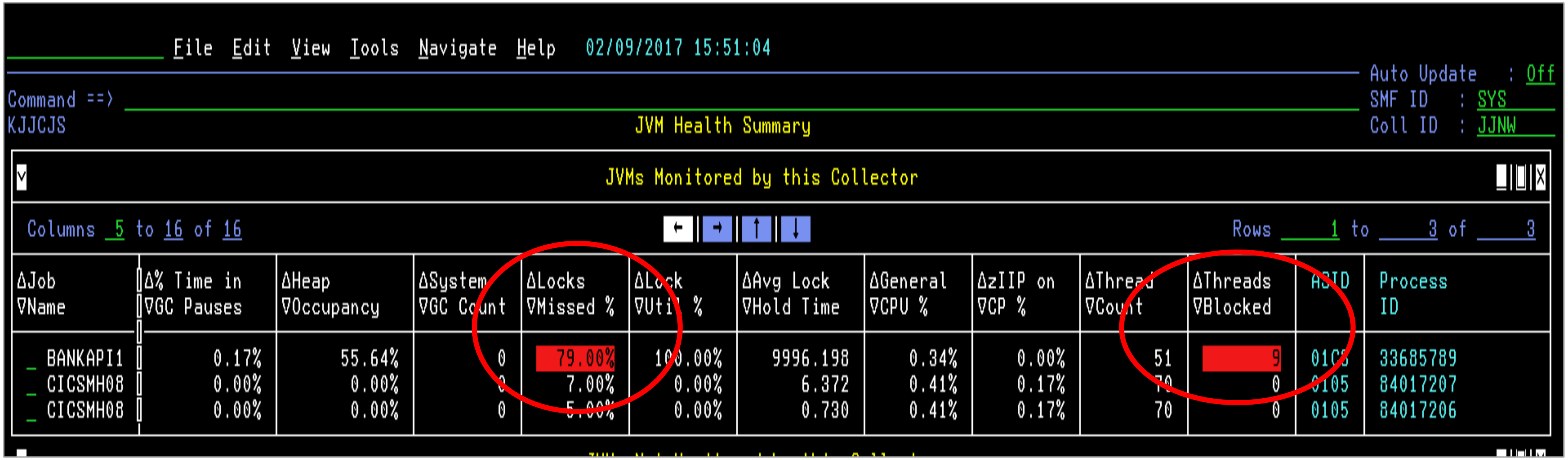
- Identifying Locks and Thread Blocks

Our applications are performing poorly. Can we see what might be the cause?

- If not GC issues, perhaps threads are being blocked for an excessive period of time or locks within the JVM are being held for long periods causing application to wait for the monitor to yield.

- If high values found here, the application owner (if applicable) can be alerted or adjustments to the JVM environment could be made.

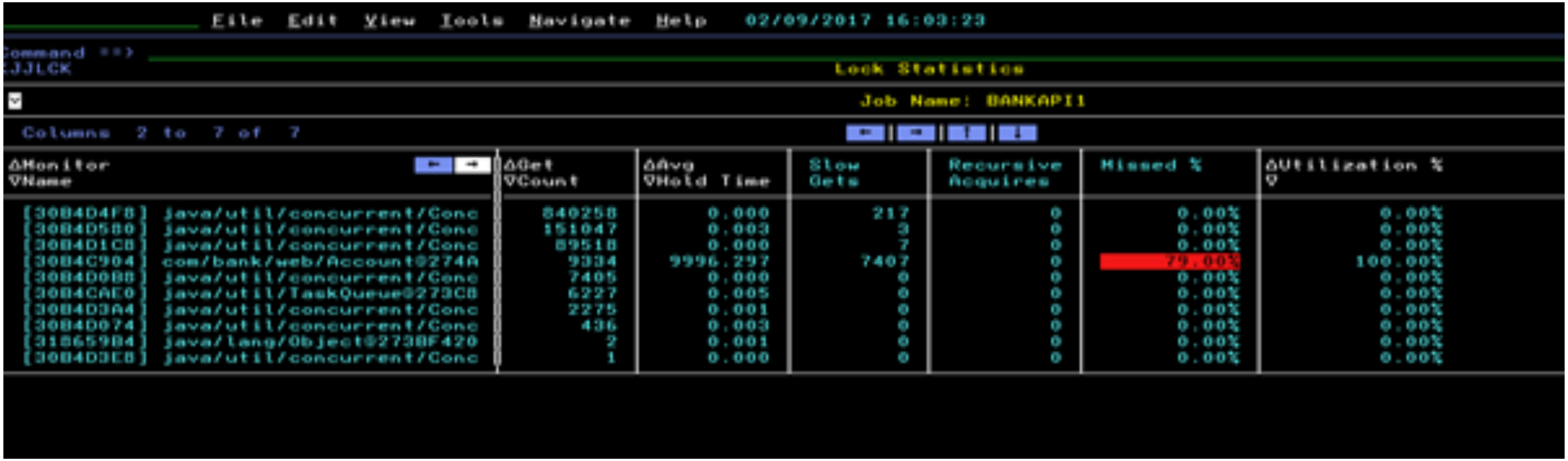
Scenario: Determine Performance Issues
- Identifying Locks and Thread Blocks



```
              File  Edit  View  Tools  Navigate  Help    02/09/2017 15:51:04
                                                                                   Auto Update   : Off
Command ==>                                                                        SMF ID  : SYS
KJJCJS                                 JVM Health Summary                          Coll ID  : JJNW

                                 JVMs Monitored by this Collector

 Columns  5 to 16 of 16                       ← → ↑ ↓                           Rows     1 to     3 of     3

 ΔJob       Δ% Time in  ΔHeap       ΔSystem   ΔLocks    ΔLock     ΔAvg Lock  ΔGeneral  ΔzIIP on  ΔThread  ΔThreads  ASID  Process
 ∇Name      ∇GC Pauses  ∇Occupancy  ∇GC Count ∇Missed % ∇Util %   ∇Hold Time ∇CPU %    ∇CP %     ∇Count   ∇Blocked        ID

 _ BANKAPI1      0.17%      55.64%          0    79.00%   100.00%   9996.198     0.34%     0.00%       51         9  01C5  33685789
 _ CICSMH08      0.00%       0.00%          0     7.00%     0.00%      6.372     0.41%     0.17%       70         0  0105  84017207
 _ CICSMH08      0.00%       0.00%          0     5.00%     0.00%      0.730     0.41%     0.17%       70         0  0105  84017206
```

Scenario: Determine Performance Issues

- Identifying Locks and Thread Blocks

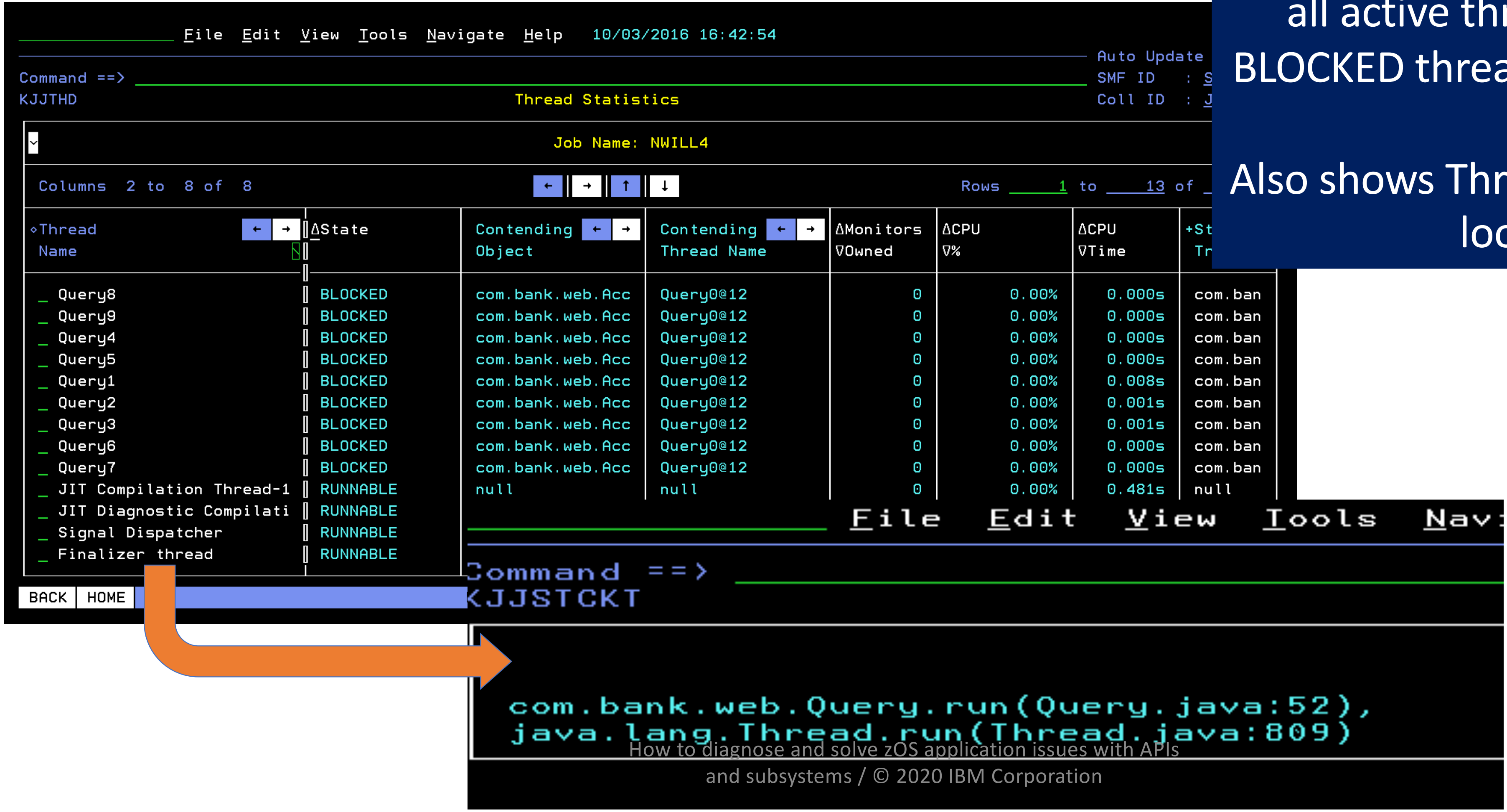


```
          File  Edit  View  Tools  Navigate  Help   02/09/2017 16:03:23
Command ==>
CJJLCK                                              Lock Statistics

                                                    Job Name: BANKAPI1
  Columns  2 to  7 of  7
ΔMonitor                               ΔGet      ΔAvg          Slow     Recursive   Missed %    ΔUtilization %
∇Name                                  ∇Count    ∇Hold Time    Gets     Acquires                ∇
 [3084D4F8] java/util/concurrent/Conc   840258        0.000      217           0       0.00%          0.00%
 [3084D580] java/util/concurrent/Conc   151047        0.003        3           0       0.00%          0.00%
 [3084D1C8] java/util/concurrent/Conc    89518        0.000        7           0       0.00%          0.00%
 [3084C904] com/bank/web/Account@274A     9334     9996.297     7407           0      79.00%        100.00%
 [3084D0B8] java/util/concurrent/Conc     7405        0.000        0           0       0.00%          0.00%
 [3084CAE0] java/util/TaskQueue@273C8     6227        0.005        0           0       0.00%          0.00%
 [3084D3A4] java/util/concurrent/Conc     2275        0.001        0           0       0.00%          0.00%
 [3084D074] java/util/concurrent/Conc      436        0.003        0           0       0.00%          0.00%
 [31865984] java/lang/Object@2738F420        2        0.001        0           0       0.00%          0.00%
 [3084D3E8] java/util/concurrent/Conc        1        0.000        0           0       0.00%          0.00%
```

The Lock Statistics shows which monitor objects were used as lock most often and how long they were held for.

Scenario: Determine Performance Issues

- Identifying Locks and Thread Blocks



```
_______________ File  Edit  View  Tools  Navigate  Help   10/03/2016 16:42:54
                                                                         Auto Update
Command ==> ____________________________________________________________ SMF ID   : S
KJJTHD                              Thread Statistics                    Coll ID  : J

                                 Job Name: NWILL4

 Columns  2 to  8 of  8                  ← → ↑ ↓                Rows ____1 to ___13 of _

 ◦Thread               ← →  ΔState        Contending ← →  Contending ← →  ΔMonitors ΔCPU    ΔCPU    +St
  Name                                    Object          Thread Name     ∇Owned    ∇%      ∇Time    Tr

 _ Query8                   BLOCKED       com.bank.web.Acc Query0@12       0     0.00%   0.000s  com.ban
 _ Query9                   BLOCKED       com.bank.web.Acc Query0@12       0     0.00%   0.000s  com.ban
 _ Query4                   BLOCKED       com.bank.web.Acc Query0@12       0     0.00%   0.000s  com.ban
 _ Query5                   BLOCKED       com.bank.web.Acc Query0@12       0     0.00%   0.000s  com.ban
 _ Query1                   BLOCKED       com.bank.web.Acc Query0@12       0     0.00%   0.008s  com.ban
 _ Query2                   BLOCKED       com.bank.web.Acc Query0@12       0     0.00%   0.001s  com.ban
 _ Query3                   BLOCKED       com.bank.web.Acc Query0@12       0     0.00%   0.001s  com.ban
 _ Query6                   BLOCKED       com.bank.web.Acc Query0@12       0     0.00%   0.000s  com.ban
 _ Query7                   BLOCKED       com.bank.web.Acc Query0@12       0     0.00%   0.000s  com.ban
 _ JIT Compilation Thread-1 RUNNABLE      null             null            0     0.00%   0.481s  null
 _ JIT Diagnostic Compilati RUNNABLE
 _ Signal Dispatcher        RUNNABLE
 _ Finalizer thread         RUNNABLE

 BACK  HOME
```

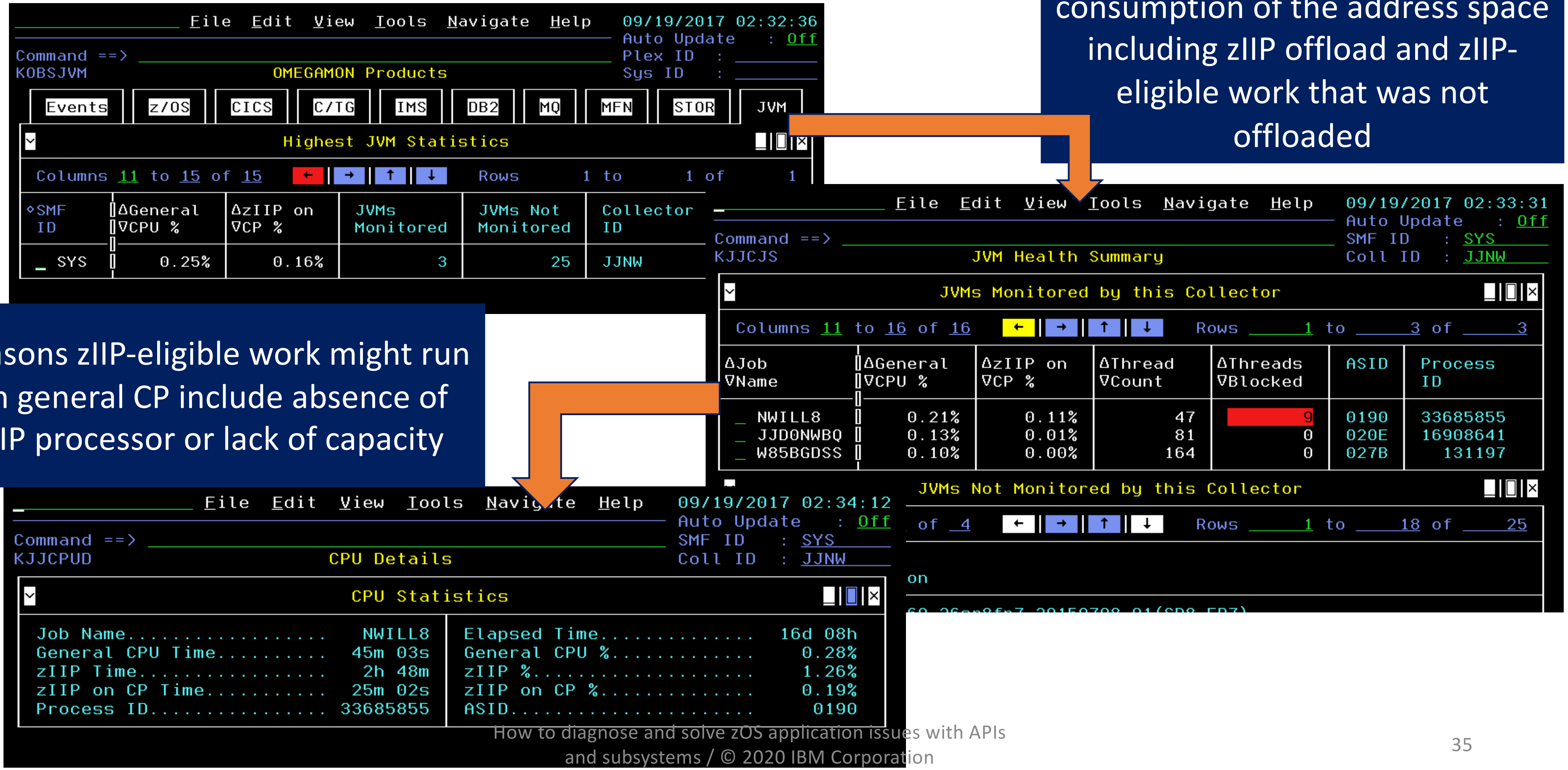
```
_______________ File  Edit  View  Tools  Nav
Command ==> ______________________________
KJJSTCKT

  com.bank.web.Query.run(Query.java:52),
  java.lang.Thread.run(Thread.java:809)
```

Thread Statistics drills-down to all active threads making BLOCKED threads easy to spot.

Also shows Thread CPU to spot loops!

Scenario: Determine Performance Issues

- CPU information



CPU Details shows the CPU consumption of the address space including zIIP offload and zIIP-eligible work that was not offloaded

Reasons zIIP-eligible work might run on general CP include absence of zIIP processor or lack of capacity

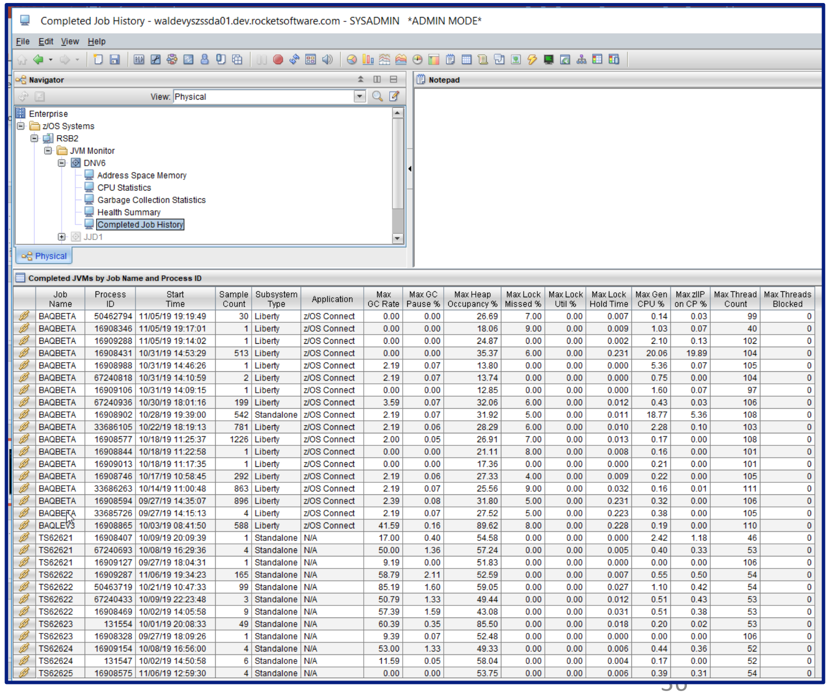
```
_______________  File  Edit  View  Tools  Navigate  Help    09/19/2017 02:32:36
                                                             Auto Update    : Off
Command ==> ____________________________________________     Plex ID   :  ________
KOBSJVM                    OMEGAMON Products                 Sys ID    :  ________

  Events   z/OS   CICS   C/TG   IMS   DB2   MQ   MFN   STOR   JVM

                        Highest JVM Statistics
 Columns 11 to 15 of 15                        Rows    1 to    1 of    1

 ◇SMF  |ΔGeneral |ΔzIIP on |  JVMs     |  JVMs Not  | Collector
  ID   |∇CPU %   |∇CP %    | Monitored | Monitored  | ID
 _ SYS |   0.25% |   0.16% |         3 |         25 | JJNW
```

```
_______________  File  Edit  View  Tools  Navigate  Help    09/19/2017 02:33:31
                                                             Auto Update    : Off
Command ==> ____________________________________________     SMF ID    :  SYS
KJJCJS                    JVM Health Summary                 Coll ID   :  JJNW

                     JVMs Monitored by this Collector
 Columns 11 to 16 of 16                      Rows ____1 to ____3 of ____3

 ΔJob       |ΔGeneral |ΔzIIP on |ΔThread |ΔThreads |ASID | Process
 ∇Name      |∇CPU %   |∇CP %    |∇Count  |∇Blocked |     | ID
 _ NWILL8   |   0.21% |   0.11% |     47 |       9 | 0190| 33685855
 _ JJDONWBQ |   0.13% |   0.01% |     81 |       0 | 020E| 16908641
 _ W85BGDSS |   0.10% |   0.00% |    164 |       0 | 027B|   131197

                   JVMs Not Monitored by this Collector
  of  4                                      Rows ____1 to ___18 of ___25

 on
```

```
_______________  File  Edit  View  Tools  Navigate  Help    09/19/2017 02:34:12
                                                             Auto Update    : Off
Command ==> ____________________________________________     SMF ID    :  SYS
KJJCPUD                      CPU Details                     Coll ID   :  JJNW

                            CPU Statistics

 Job Name..................   NWILL8 | Elapsed Time..............  16d 08h
 General CPU Time..........  45m 03s | General CPU %.............    0.28%
 zIIP Time.................   2h 48m | zIIP %....................    1.26%
 zIIP on CP Time...........  25m 02s | zIIP on CP %..............    0.19%
 Process ID................ 33685855 | ASID......................     0190
```

IBM Z OMEGAMON for JVM, V5.5
Completed JVM History (including JVM Batch)

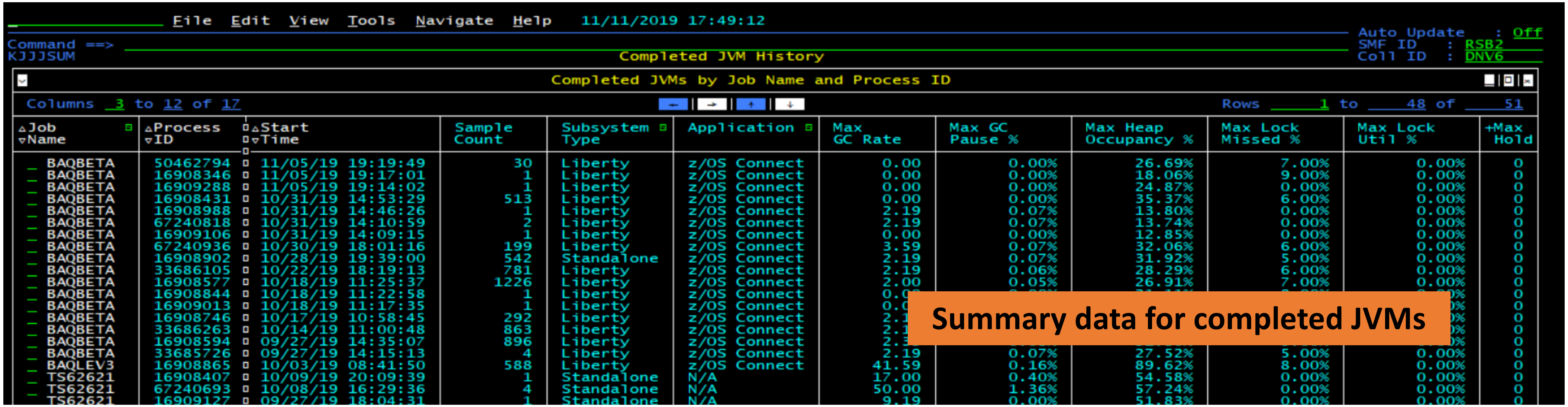
- Access to history of JVMs *not currently running*
- Reads Persistent Data Store (PDS) JVM.HEALTH near-term history.
- HEALTH history must be enabled
- Period covered determined by:
    - Size of PDS datasets
    - Frequency of history collection
    - Number of tables collecting history



Completed JVMs by Job Name and Process ID

Job Name	Process ID	Start Time	Sample Count	Subsystem Type	Application	Max GC Rate	Max GC Pause %	Max Heap Occupancy %	Max Lock Missed %	Max Lock Util %	Max Lock Hold Time	Max Gen CPU %	Max zIIP on CP %	Max Thread Count	Max Threads Blocked
BAQBETA	50462794	11/05/19 19:19:49	30	Liberty	z/OS Connect	0.00	0.00	26.69	7.00	0.00	0.007	0.14	0.03	99	0
BAQBETA	16908346	11/05/19 19:17:01	1	Liberty	z/OS Connect	0.00	0.00	18.06	9.00	0.00	0.009	1.03	0.07	40	0
BAQBETA	16909288	11/05/19 19:14:02	1	Liberty	z/OS Connect	0.00	0.00	24.87	0.00	0.00	0.002	2.10	0.13	102	0
BAQBETA	16908431	10/31/19 14:53:29	513	Liberty	z/OS Connect	0.00	0.00	35.37	6.00	0.00	0.231	20.06	19.89	104	0
BAQBETA	16908988	10/31/19 14:46:26	1	Liberty	z/OS Connect	2.19	0.07	13.80	0.00	0.00	0.000	5.36	0.07	105	0
BAQBETA	67240818	10/31/19 14:10:59	2	Liberty	z/OS Connect	2.19	0.07	13.74	0.00	0.00	0.000	0.75	0.00	104	0
BAQBETA	16909106	10/31/19 14:09:15	1	Liberty	z/OS Connect	0.00	0.00	12.85	0.00	0.00	0.000	1.60	0.07	97	0
BAQBETA	67240936	10/30/19 18:01:16	199	Liberty	z/OS Connect	3.59	0.07	32.06	6.00	0.00	0.012	0.43	0.03	106	0
BAQBETA	16908902	10/28/19 19:39:00	542	Standalone	z/OS Connect	2.19	0.07	31.92	5.00	0.00	0.011	18.77	5.36	108	0
BAQBETA	33686105	10/22/19 18:19:13	781	Liberty	z/OS Connect	2.19	0.06	28.29	6.00	0.00	0.010	2.28	0.10	103	0
BAQBETA	16908577	10/18/19 11:25:37	1226	Liberty	z/OS Connect	2.00	0.05	26.91	7.00	0.00	0.013	0.17	0.00	108	0
BAQBETA	16908844	10/18/19 11:22:58	1	Liberty	z/OS Connect	0.00	0.00	21.11	8.00	0.00	0.008	0.16	0.00	101	0
BAQBETA	16909013	10/18/19 11:17:35	1	Liberty	z/OS Connect	0.00	0.00	17.36	0.00	0.00	0.000	0.21	0.00	101	0
BAQBETA	16908746	10/17/19 10:58:45	292	Liberty	z/OS Connect	2.19	0.06	27.33	4.00	0.00	0.009	0.22	0.00	105	0
BAQBETA	33686263	10/14/19 11:00:48	863	Liberty	z/OS Connect	2.19	0.07	25.56	9.00	0.00	0.032	0.16	0.01	111	0
BAQBETA	16908594	09/27/19 14:35:07	896	Liberty	z/OS Connect	2.39	0.08	31.80	5.00	0.00	0.231	0.32	0.00	106	0
BAQBETA	33685726	09/27/19 14:15:13	4	Liberty	z/OS Connect	2.19	0.07	27.52	5.00	0.00	0.223	0.38	0.00	105	0
BAQLEV3	16908865	10/03/19 08:41:50	588	Liberty	z/OS Connect	41.59	0.16	89.62	8.00	0.00	0.228	0.19	0.00	110	0
TS62621	16908407	10/09/19 20:09:39	1	Standalone	N/A	17.00	0.40	54.58	0.00	0.00	0.000	2.42	1.18	46	0
TS62621	67240693	10/08/19 16:29:36	4	Standalone	N/A	50.00	1.36	57.24	0.00	0.00	0.005	0.40	0.33	53	0
TS62621	16909127	09/27/19 18:04:31	1	Standalone	N/A	9.19	0.00	51.83	0.00	0.00	0.000	0.00	0.00	106	0
TS62622	16909287	11/06/19 19:34:23	165	Standalone	N/A	58.79	2.11	52.59	0.00	0.00	0.007	0.55	0.50	54	0
TS62622	50463719	10/21/19 10:47:33	99	Standalone	N/A	85.19	1.60	59.05	0.00	0.00	0.027	1.10	0.42	54	0
TS62622	67240433	10/09/19 22:23:48	3	Standalone	N/A	50.79	1.33	49.44	0.00	0.00	0.012	0.51	0.43	53	0
TS62622	16908469	10/02/19 14:05:58	9	Standalone	N/A	57.39	1.59	43.08	0.00	0.00	0.031	0.51	0.38	53	0
TS62623	131554	10/01/19 20:08:33	49	Standalone	N/A	60.39	0.35	85.50	0.00	0.00	0.018	0.20	0.02	53	0
TS62623	16908328	09/27/19 18:09:26	1	Standalone	N/A	9.39	0.07	52.48	0.00	0.00	0.000	0.00	0.00	106	0
TS62624	16909154	10/08/19 16:56:00	4	Standalone	N/A	53.00	1.33	49.33	0.00	0.00	0.006	0.44	0.36	52	0
TS62624	131547	10/02/19 14:50:58	6	Standalone	N/A	11.59	0.05	58.04	0.00	0.00	0.004	0.17	0.00	52	0
TS62625	16908575	11/06/19 12:59:30	4	Standalone	N/A	0.00	0.00	53.75	0.00	0.00	0.006	0.39	0.31	54	0

Scenario: Review Performance History



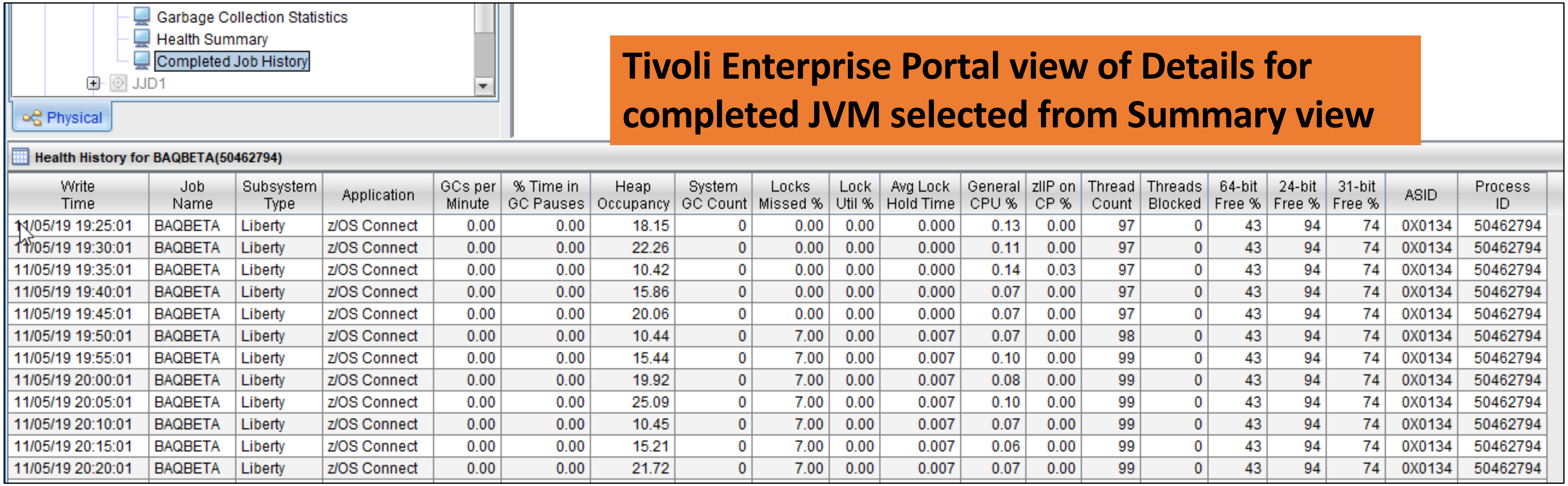
```
11/11/2019 17:49:12
Command ==>                                                  Auto Update   : Off
                                                             SMF ID   : RSB2
KJJJSUM                    Completed JVM History             Coll ID  : DNV6
              Completed JVMs by Job Name and Process ID
Columns  3 to 12 of 17                                 Rows  1 to  48 of  51
```

Job Name	Process ID	Start Time	Sample Count	Subsystem Type	Application	Max GC Rate	Max GC Pause %	Max Heap Occupancy %	Max Lock Missed %	Max Lock Util %	+Max Hold
BAQBETA	50462794	11/05/19 19:19:49	30	Liberty	z/OS Connect	0.00	0.00%	26.69%	7.00%	0.00%	0
BAQBETA	16908346	11/05/19 19:17:01	1	Liberty	z/OS Connect	0.00	0.00%	18.06%	9.00%	0.00%	0
BAQBETA	16909288	11/05/19 19:14:02	1	Liberty	z/OS Connect	0.00	0.00%	24.87%	0.00%	0.00%	0
BAQBETA	16908431	10/31/19 14:53:29	513	Liberty	z/OS Connect	0.00	0.00%	35.37%	6.00%	0.00%	0
BAQBETA	16908988	10/31/19 14:46:26	1	Liberty	z/OS Connect	2.19	0.07%	13.80%	0.00%	0.00%	0
BAQBETA	67240818	10/31/19 14:10:59	2	Liberty	z/OS Connect	2.19	0.07%	13.74%	0.00%	0.00%	0
BAQBETA	16909106	10/31/19 14:09:15	1	Liberty	z/OS Connect	0.00	0.00%	12.85%	0.00%	0.00%	0
BAQBETA	67240936	10/30/19 18:01:16	199	Liberty	z/OS Connect	3.59	0.07%	32.06%	6.00%	0.00%	0
BAQBETA	16908902	10/28/19 19:39:00	542	Standalone	z/OS Connect	2.19	0.07%	31.92%	5.00%	0.00%	0
BAQBETA	33686105	10/22/19 18:19:13	781	Liberty	z/OS Connect	2.19	0.06%	28.29%	6.00%	0.00%	0
BAQBETA	16908577	10/18/19 11:25:37	1226	Liberty	z/OS Connect	2.00	0.05%	26.91%	7.00%	0.00%	0
BAQBETA	16908844	10/18/19 11:22:58	1	Liberty	z/OS Connect	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0
BAQBETA	16909013	10/18/19 11:17:35	1	Liberty	z/OS Connect	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0
BAQBETA	16908746	10/17/19 10:58:45	292	Liberty	z/OS Connect	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0
BAQBETA	33686263	10/14/19 11:00:48	863	Liberty	z/OS Connect	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0
BAQBETA	16908594	09/27/19 14:35:07	896	Liberty	z/OS Connect	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0
BAQBETA	33685726	09/27/19 14:15:13	4	Liberty	z/OS Connect	2.19	0.07%	27.52%	5.00%	0.00%	0
BAQLEV3	16908865	10/03/19 08:41:50	588	Liberty	z/OS Connect	41.59	0.16%	89.62%	8.00%	0.00%	0
TS62621	16908407	10/09/19 20:09:39	1	Standalone	N/A	17.00	0.40%	54.58%	0.00%	0.00%	0
TS62621	67240693	10/08/19 16:29:36	4	Standalone	N/A	50.00	1.36%	57.24%	0.00%	0.00%	0
TS62621	16909127	09/27/19 18:04:31	1	Standalone	N/A	9.19	0.00%	51.83%	0.00%	0.00%	0

Summary data for completed JVMs

See at a glance the summary metrics for completed JVMs not currently running;
Then choose a JVM and drill down to see more details about that particular Job Name

Scenario: Review Performance History



Tivoli Enterprise Portal view of Details for completed JVM selected from Summary view

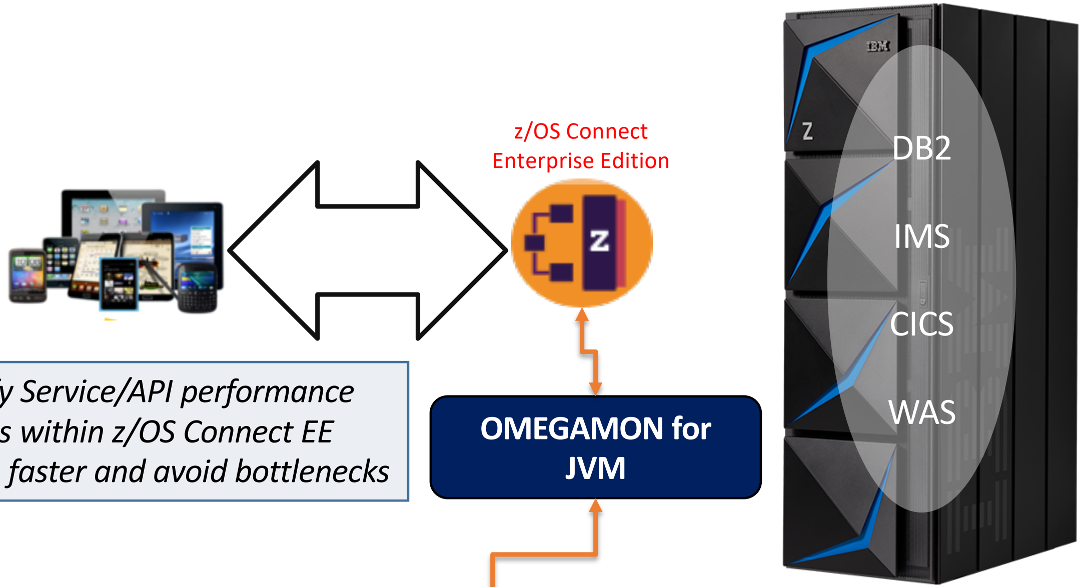
Health History for BAQBETA(50462794)

Write Time	Job Name	Subsystem Type	Application	GCs per Minute	% Time in GC Pauses	Heap Occupancy	System GC Count	Locks Missed %	Lock Util %	Avg Lock Hold Time	General CPU %	zIIP on CP %	Thread Count	Threads Blocked	64-bit Free %	24-bit Free %	31-bit Free %	ASID	Process ID
11/05/19 19:25:01	BAQBETA	Liberty	z/OS Connect	0.00	0.00	18.15	0	0.00	0.00	0.000	0.13	0.00	97	0	43	94	74	0X0134	50462794
11/05/19 19:30:01	BAQBETA	Liberty	z/OS Connect	0.00	0.00	22.26	0	0.00	0.00	0.000	0.11	0.00	97	0	43	94	74	0X0134	50462794
11/05/19 19:35:01	BAQBETA	Liberty	z/OS Connect	0.00	0.00	10.42	0	0.00	0.00	0.000	0.14	0.03	97	0	43	94	74	0X0134	50462794
11/05/19 19:40:01	BAQBETA	Liberty	z/OS Connect	0.00	0.00	15.86	0	0.00	0.00	0.000	0.07	0.00	97	0	43	94	74	0X0134	50462794
11/05/19 19:45:01	BAQBETA	Liberty	z/OS Connect	0.00	0.00	20.06	0	0.00	0.00	0.000	0.07	0.00	97	0	43	94	74	0X0134	50462794
11/05/19 19:50:01	BAQBETA	Liberty	z/OS Connect	0.00	0.00	10.44	0	7.00	0.00	0.007	0.07	0.00	98	0	43	94	74	0X0134	50462794
11/05/19 19:55:01	BAQBETA	Liberty	z/OS Connect	0.00	0.00	15.44	0	7.00	0.00	0.007	0.10	0.00	99	0	43	94	74	0X0134	50462794
11/05/19 20:00:01	BAQBETA	Liberty	z/OS Connect	0.00	0.00	19.92	0	7.00	0.00	0.007	0.08	0.00	99	0	43	94	74	0X0134	50462794
11/05/19 20:05:01	BAQBETA	Liberty	z/OS Connect	0.00	0.00	25.09	0	7.00	0.00	0.007	0.10	0.00	99	0	43	94	74	0X0134	50462794
11/05/19 20:10:01	BAQBETA	Liberty	z/OS Connect	0.00	0.00	10.45	0	7.00	0.00	0.007	0.07	0.00	99	0	43	94	74	0X0134	50462794
11/05/19 20:15:01	BAQBETA	Liberty	z/OS Connect	0.00	0.00	15.21	0	7.00	0.00	0.007	0.06	0.00	99	0	43	94	74	0X0134	50462794
11/05/19 20:20:01	BAQBETA	Liberty	z/OS Connect	0.00	0.00	21.72	0	7.00	0.00	0.007	0.07	0.00	99	0	43	94	74	0X0134	50462794

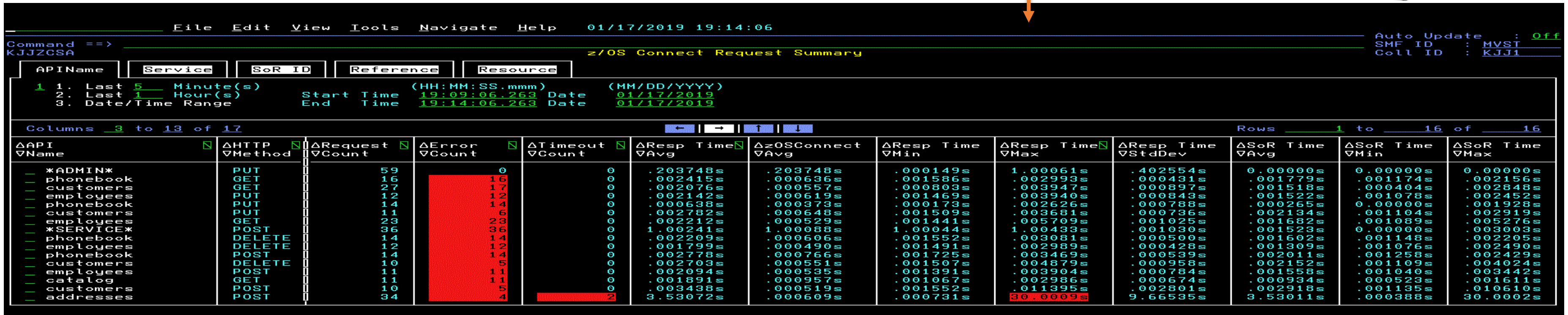
Display the details you need to investigate a particular Jobname

Scenario: Determine z/OS Connect EE API Performance Issues

Reports are coming back that application request response time into z/OS is poor. Can we identify affected APIs?



Identify Service/API performance issues within z/OS Connect EE instances faster and avoid bottlenecks



```
              File   Edit   View   Tools   Navigate   Help    01/17/2019 19:14:06
                                                                                    Auto Update  : Off
Command ==>                                                                         SMF ID       : MVST
KJJZCSA                                      z/OS Connect Request Summary           Coll ID      : KJJ1
 APIName   Service   SoR ID   Reference   Resource
  1  1. Last 5    Minute(s)                     (HH:MM:SS.mmm)     (MM/DD/YYYY)
     2. Last 1    Hour(s)          Start Time   19:09:06.263 Date  01/17/2019
     3. Date/Time Range            End   Time   19:14:06.263 Date  01/17/2019

  Columns  3 to 13 of 17                   ← | → | ↑ | ↓                     Rows    1 to   16 of   16
```

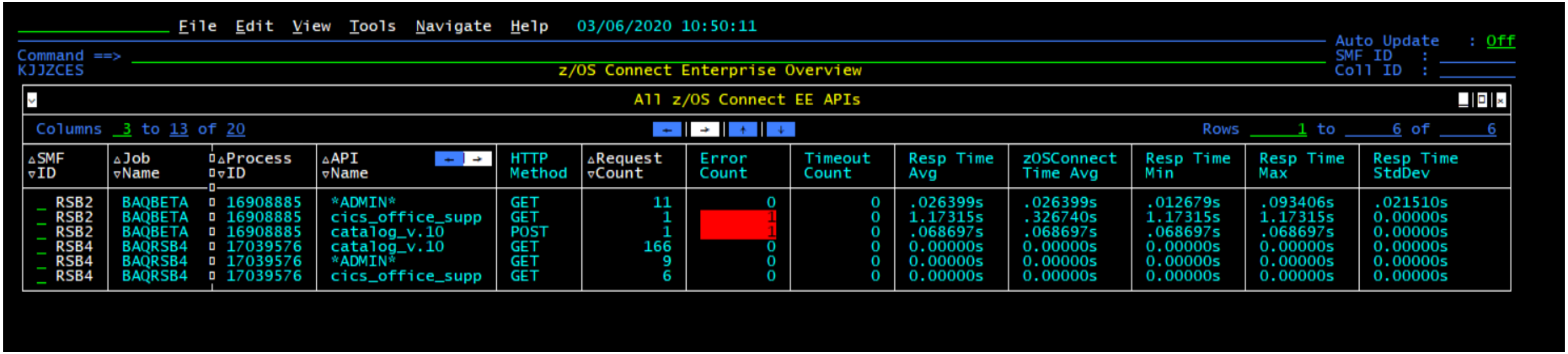
ΔAPI ∇Name	ΔHTTP ∇Method	ΔRequest ∇Count	ΔError ∇Count	ΔTimeout ∇Count	ΔResp Time ∇Avg	ΔzOSConnect ∇Avg	ΔResp Time ∇Min	ΔResp Time ∇Max	ΔResp Time ∇StdDev	ΔSoR Time ∇Avg	ΔSoR Time ∇Min	ΔSoR Time ∇Max
ADMIN	PUT	59	0	0	.203748s	.203748s	.000149s	1.00061s	.402554s	0.00000s	0.00000s	0.00000s
phonebook	GET	16	16	0	.002415s	.000636s	.001586s	.002993s	.000431s	.001779s	.001174s	.002156s
customers	GET	27	17	0	.002076s	.000557s	.000803s	.003947s	.000897s	.001518s	.000404s	.002848s
employees	PUT	12	12	0	.002142s	.000619s	.001469s	.003940s	.000843s	.001522s	.001078s	.002452s
phonebook	PUT	14	14	0	.000638s	.000373s	.000173s	.002626s	.000788s	.000265s	0.00000s	.001928s
customers	PUT	11	6	0	.002782s	.000648s	.001509s	.003681s	.000736s	.002134s	.001104s	.002919s
employees	GET	23	23	0	.002212s	.000529s	.001441s	.005709s	.001025s	.001682s	.001089s	.005276s
SERVICE	POST	36	36	0	1.00241s	1.00088s	1.00044s	1.00433s	.001030s	.001523s	0.00000s	.003003s
phonebook	DELETE	14	14	0	.002209s	.000606s	.001552s	.003081s	.000500s	.001602s	.001148s	.002205s
employees	DELETE	12	12	0	.001799s	.000490s	.001491s	.002989s	.000428s	.001309s	.001076s	.002490s
phonebook	POST	14	14	0	.002778s	.000766s	.001725s	.003469s	.000539s	.002011s	.001258s	.002429s
customers	DELETE	10	5	0	.002703s	.000551s	.001507s	.004879s	.000958s	.002152s	.001109s	.004024s
employees	POST	11	11	0	.002094s	.000535s	.001391s	.003904s	.000784s	.001558s	.001040s	.003442s
catalog	GET	11	11	0	.001891s	.000957s	.001067s	.002986s	.000674s	.000934s	.000523s	.001611s
customers	POST	10	5	0	.003438s	.000519s	.001552s	.011395s	.002801s	.002918s	.001135s	.010610s
addresses	POST	34	4	2	3.53072s	.000609s	.000731s	30.0009s	9.66535s	3.53011s	.000388s	30.0002s

Scenario: Determine z/OS Connect EE API Performance Issues

- z/OS Connect EE - API Enterprise Summary

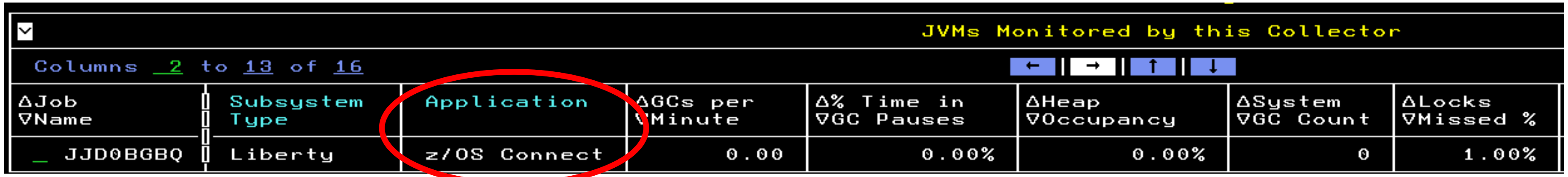
IBM Z OMEGAMON for JVM, V5.5

- Useful summary to monitor all z/OS Connect EE API's at-a-glance
- Shows all APIs executed on all z/OS Connect EE servers on all monitored LPARs (during the last five minutes)



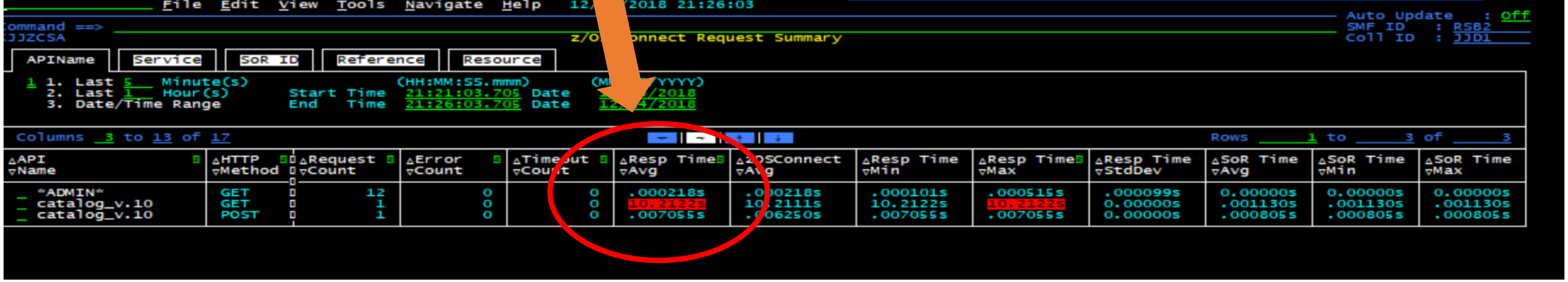
```
_____________  File  Edit  View  Tools  Navigate  Help   03/06/2020 10:50:11
                                                                              Auto Update   : Off
Command ==> ____________________________________________________________________ SMF ID  : ________
KJJZCES                              z/OS Connect Enterprise Overview          Coll ID : ________
                                    All z/OS Connect EE APIs
 Columns  3 to 13 of 20                                               Rows     1 to     6 of     6
 SMF   Job      Process   API                HTTP   Request Error  Timeout Resp Time zOSConnect Resp Time Resp Time Resp Time
 ID    Name     ID        Name               Method Count   Count  Count   Avg       Time Avg   Min       Max       StdDev
_ RSB2 BAQBETA  16908885  *ADMIN*            GET         11      0       0 .026399s  .026399s   .012679s  .093406s  .021510s
_ RSB2 BAQBETA  16908885  cics_office_supp   GET          1      1       0 1.17315s  .326740s   1.17315s  1.17315s  0.00000s
_ RSB2 BAQBETA  16908885  catalog_v.10       POST         1      1       0 .068697s  .068697s   .068697s  .068697s  0.00000s
_ RSB4 BAQRSB4  17039576  catalog_v.10       GET        166      0       0 0.00000s  0.00000s   0.00000s  0.00000s  0.00000s
_ RSB4 BAQRSB4  17039576  *ADMIN*            GET          9      0       0 0.00000s  0.00000s   0.00000s  0.00000s  0.00000s
_ RSB4 BAQRSB4  17039576  cics_office_supp   GET          6      0       0 0.00000s  0.00000s   0.00000s  0.00000s  0.00000s
```

Scenario: Determine z/OS Connect EE API Performance Issues



```
                                          JVMs Monitored by this Collector
 Columns  2 to 13 of 16
ΔJob            Subsystem      Application    ΔGCs per      Δ% Time in    ΔHeap          ΔSystem      ΔLocks
∇Name           Type                          ∇Minute       ∇GC Pauses    ∇Occupancy     ∇GC Count    ∇Missed %
_  JJD0BGBQ     Liberty        z/OS Connect        0.00          0.00%          0.00%            0        1.00%
```

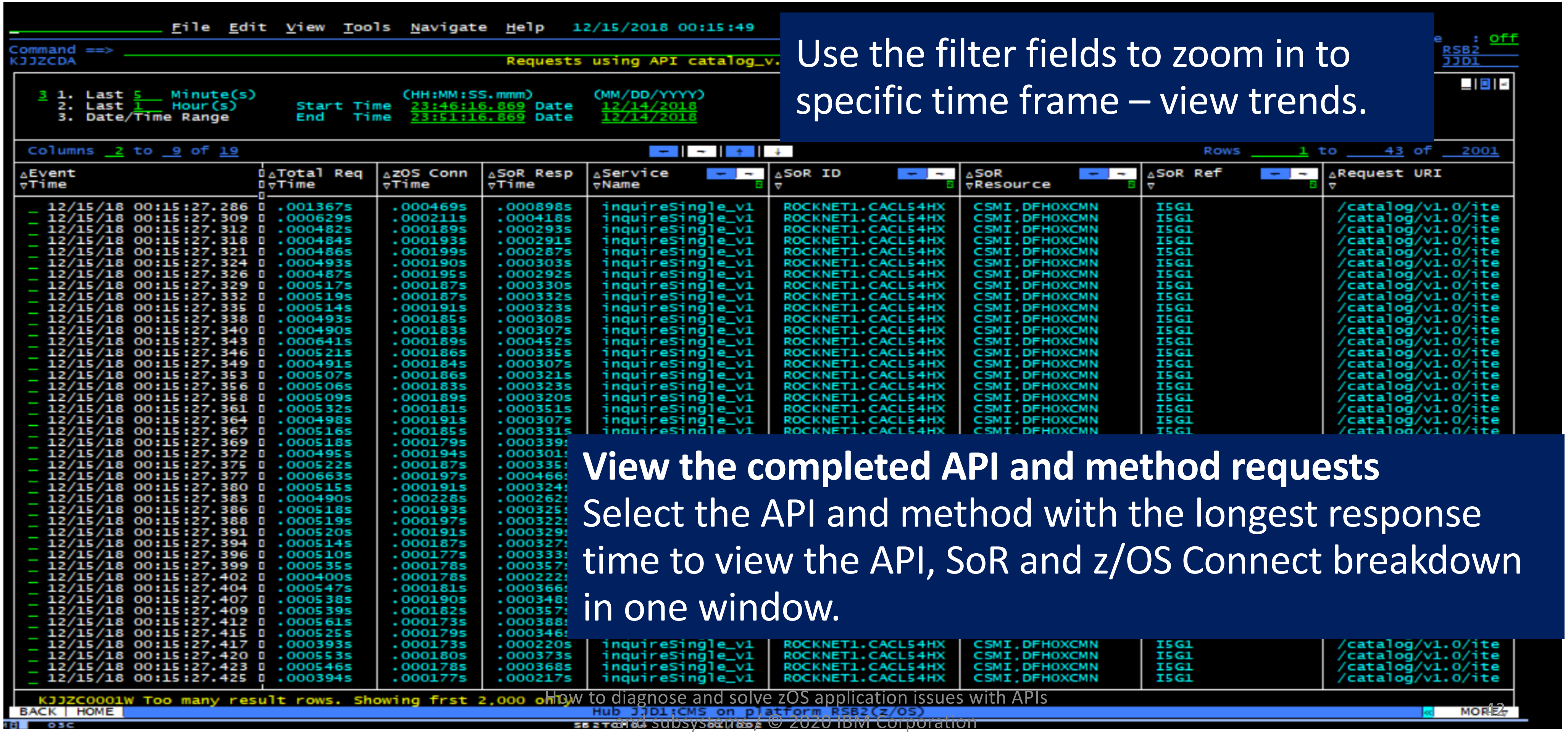
Identify the z/OS Connect Job by looking at the Application field. Select the Job using option 'Z'



```
____________ File  Edit  View  Tools  Navigate  Help   12/04/2018 21:26:03
                                                                               Auto Update   : Off
Command ==> ____________________________________________________________      SMF ID        : RSB2
KJJZCSA                               z/OS Connect Request Summary             Coll ID       : JJD1
 APIName   Service   SoR ID   Reference   Resource
 1 1. Last 5__ Minute(s)          (HH:MM:SS.mmm)     (MM/DD/YYYY)
   2. Last 1__ Hour(s)   Start Time 21:21:03.705 Date 12/04/2018
   3. Date/Time Range    End   Time 21:26:03.705 Date 12/04/2018
 Columns  3 to 13 of 17                                                        Rows        1 to      3 of      3
ΔAPI            ΔHTTP   ΔRequest  ΔError  ΔTimeout ΔResp Time ΔzOSConnect ΔResp Time ΔResp Time ΔResp Time ΔSoR Time ΔSoR Time ΔSoR Time
∇Name           ∇Method ∇Count    ∇Count  ∇Count   ∇Avg       ∇Avg        ∇Min       ∇Max       ∇StdDev    ∇Avg      ∇Min      ∇Max
_  *ADMIN*       GET        12        0       0    .000218s   .000218s    .000101s   .000515s   .000099s   0.00000s  0.00000s  0.00000s
_  catalog_v.10  GET         1        0       0    10.2122s   10.2111s    10.2122s   10.2122s   0.00000s   .001130s  .001130s  .001130s
_  catalog_v.10  POST        1        0       0    .007055s   .006250s    .007055s   .007055s   0.00000s   .000805s  .000805s  .000805s
```

Sort the rows by 'Avg Response Time' - Identify and select the API name with highest Avg Response Time. Selecting option 'S' will display all requests completed in the last interval

Scenario: Determine z/OS Connect EE API Performance Issues

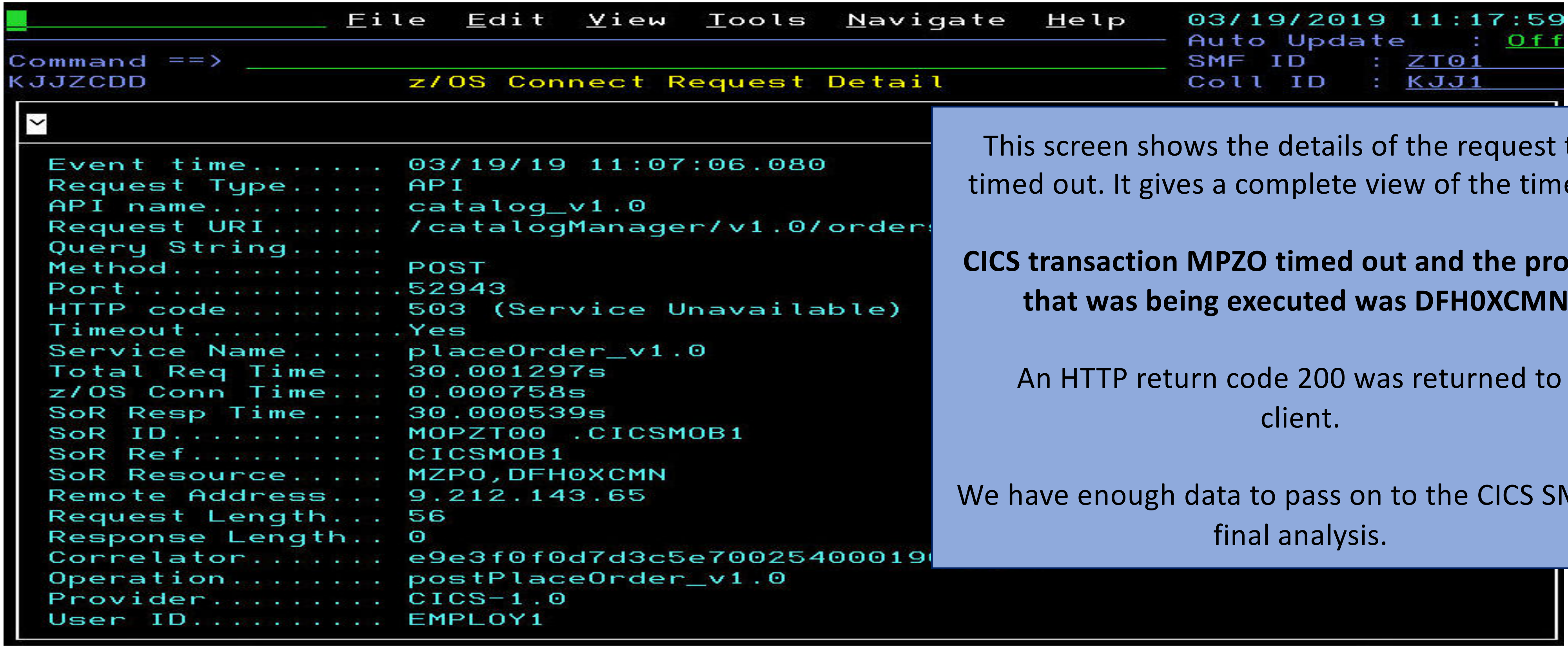


```
_______________________  File  Edit  View  Tools  Navigate  Help   12/15/2018 00:15:49                 e   : Off
Command ==> ________________________________________________________________________________            RSB2
KJJZCDA                                            Requests using API catalog_v.                          JJD1

  3  1. Last 5__  Minute(s)                        (HH:MM:SS.mmm)   (MM/DD/YYYY)
     2. Last 1__  Hour(s)            Start Time    23:46:16.869 Date 12/14/2018
     3. Date/Time Range              End   Time    23:51:16.869 Date 12/14/2018

 Columns  _2 to _9 of 19                                                            Rows ____1 to ___43 of __2001
 ΔEvent                    ΔTotal Req  ΔzOS Conn  ΔSoR Resp  ΔService          ΔSoR ID              ΔSoR              ΔSoR Ref   ΔRequest URI
 ∇Time                     ∇Time       ∇Time      ∇Time      ∇Name             ∇                    ∇Resource         ∇          ∇
 _ 12/15/18 00:15:27.286    .001367s    .000469s   .000898s   inquireSingle_v1  ROCKNET1.CACL54HX    CSMI.DFHOXCMN     I5G1       /catalog/v1.0/ite
 _ 12/15/18 00:15:27.309    .000629s    .000211s   .000418s   inquireSingle_v1  ROCKNET1.CACL54HX    CSMI.DFHOXCMN     I5G1       /catalog/v1.0/ite
 _ 12/15/18 00:15:27.312    .000482s    .000189s   .000293s   inquireSingle_v1  ROCKNET1.CACL54HX    CSMI.DFHOXCMN     I5G1       /catalog/v1.0/ite
 _ 12/15/18 00:15:27.318    .000484s    .000193s   .000291s   inquireSingle_v1  ROCKNET1.CACL54HX    CSMI.DFHOXCMN     I5G1       /catalog/v1.0/ite
 _ 12/15/18 00:15:27.321    .000486s    .000199s   .000287s   inquireSingle_v1  ROCKNET1.CACL54HX    CSMI.DFHOXCMN     I5G1       /catalog/v1.0/ite
 _ 12/15/18 00:15:27.324    .000493s    .000190s   .000303s   inquireSingle_v1  ROCKNET1.CACL54HX    CSMI.DFHOXCMN     I5G1       /catalog/v1.0/ite
 _ 12/15/18 00:15:27.326    .000487s    .000195s   .000292s   inquireSingle_v1  ROCKNET1.CACL54HX    CSMI.DFHOXCMN     I5G1       /catalog/v1.0/ite
 _ 12/15/18 00:15:27.329    .000517s    .000187s   .000330s   inquireSingle_v1  ROCKNET1.CACL54HX    CSMI.DFHOXCMN     I5G1       /catalog/v1.0/ite
 _ 12/15/18 00:15:27.332    .000519s    .000187s   .000332s   inquireSingle_v1  ROCKNET1.CACL54HX    CSMI.DFHOXCMN     I5G1       /catalog/v1.0/ite
 _ 12/15/18 00:15:27.335    .000514s    .000191s   .000323s   inquireSingle_v1  ROCKNET1.CACL54HX    CSMI.DFHOXCMN     I5G1       /catalog/v1.0/ite
 _ 12/15/18 00:15:27.338    .000493s    .000185s   .000308s   inquireSingle_v1  ROCKNET1.CACL54HX    CSMI.DFHOXCMN     I5G1       /catalog/v1.0/ite
 _ 12/15/18 00:15:27.340    .000490s    .000183s   .000307s   inquireSingle_v1  ROCKNET1.CACL54HX    CSMI.DFHOXCMN     I5G1       /catalog/v1.0/ite
 _ 12/15/18 00:15:27.343    .000641s    .000189s   .000452s   inquireSingle_v1  ROCKNET1.CACL54HX    CSMI.DFHOXCMN     I5G1       /catalog/v1.0/ite
 _ 12/15/18 00:15:27.346    .000521s    .000186s   .000335s   inquireSingle_v1  ROCKNET1.CACL54HX    CSMI.DFHOXCMN     I5G1       /catalog/v1.0/ite
 _ 12/15/18 00:15:27.349    .000491s    .000184s   .000307s   inquireSingle_v1  ROCKNET1.CACL54HX    CSMI.DFHOXCMN     I5G1       /catalog/v1.0/ite
 _ 12/15/18 00:15:27.353    .000507s    .000186s   .000321s   inquireSingle_v1  ROCKNET1.CACL54HX    CSMI.DFHOXCMN     I5G1       /catalog/v1.0/ite
 _ 12/15/18 00:15:27.356    .000506s    .000183s   .000323s   inquireSingle_v1  ROCKNET1.CACL54HX    CSMI.DFHOXCMN     I5G1       /catalog/v1.0/ite
 _ 12/15/18 00:15:27.358    .000509s    .000189s   .000320s   inquireSingle_v1  ROCKNET1.CACL54HX    CSMI.DFHOXCMN     I5G1       /catalog/v1.0/ite
 _ 12/15/18 00:15:27.361    .000532s    .000181s   .000351s   inquireSingle_v1  ROCKNET1.CACL54HX    CSMI.DFHOXCMN     I5G1       /catalog/v1.0/ite
 _ 12/15/18 00:15:27.364    .000498s    .000191s   .000307s   inquireSingle_v1  ROCKNET1.CACL54HX    CSMI.DFHOXCMN     I5G1       /catalog/v1.0/ite
 _ 12/15/18 00:15:27.367    .000516s    .000185s   .000331s   inquireSingle_v1  ROCKNET1.CACL54HX    CSMI.DFHOXCMN     I5G1       /catalog/v1.0/ite
 _ 12/15/18 00:15:27.369    .000518s    .000179s   .000339
 _ 12/15/18 00:15:27.372    .000495s    .000194s   .000301
 _ 12/15/18 00:15:27.375    .000522s    .000187s   .000335
 _ 12/15/18 00:15:27.377    .000663s    .000197s   .000466
 _ 12/15/18 00:15:27.380    .000515s    .000191s   .000324
 _ 12/15/18 00:15:27.383    .000490s    .000228s   .000262
 _ 12/15/18 00:15:27.386    .000518s    .000193s   .000325
 _ 12/15/18 00:15:27.388    .000519s    .000197s   .000322
 _ 12/15/18 00:15:27.391    .000520s    .000191s   .000329
 _ 12/15/18 00:15:27.394    .000514s    .000187s   .000327
 _ 12/15/18 00:15:27.396    .000510s    .000177s   .000333
 _ 12/15/18 00:15:27.399    .000535s    .000178s   .000357
 _ 12/15/18 00:15:27.402    .000400s    .000178s   .000222
 _ 12/15/18 00:15:27.404    .000547s    .000181s   .000366
 _ 12/15/18 00:15:27.407    .000538s    .000190s   .000348
 _ 12/15/18 00:15:27.409    .000539s    .000182s   .000357
 _ 12/15/18 00:15:27.412    .000561s    .000173s   .000388
 _ 12/15/18 00:15:27.415    .000525s    .000179s   .000346
 _ 12/15/18 00:15:27.417    .000393s    .000173s   .000220s   inquireSingle_v1  ROCKNET1.CACL54HX    CSMI.DFHOXCMN     I5G1       /catalog/v1.0/ite
 _ 12/15/18 00:15:27.420    .000553s    .000180s   .000373s   inquireSingle_v1  ROCKNET1.CACL54HX    CSMI.DFHOXCMN     I5G1       /catalog/v1.0/ite
 _ 12/15/18 00:15:27.423    .000546s    .000178s   .000368s   inquireSingle_v1  ROCKNET1.CACL54HX    CSMI.DFHOXCMN     I5G1       /catalog/v1.0/ite
 _ 12/15/18 00:15:27.425    .000394s    .000177s   .000217s   inquireSingle_v1  ROCKNET1.CACL54HX    CSMI.DFHOXCMN     I5G1       /catalog/v1.0/ite
   KJJZC0001W Too many result rows.  Showing frst 2,000 only
 BACK | HOME                            Hub JJD1:CMS on platform RSB2(z/OS)                                            MORE
      03C
```

Use the filter fields to zoom in to specific time frame – view trends.

View the completed API and method requests
Select the API and method with the longest response time to view the API, SoR and z/OS Connect breakdown in one window.

Scenario: Determine z/OS Connect EE API Performance Issues



```
_____________________ File   Edit   View   Tools   Navigate   Help       03/19/2019 11:17:59
                                                                           Auto Update      : Off
Command ==> ______________________________________________________________    SMF ID     : ZT01
KJJZCDD                z/OS Connect Request Detail                         Coll ID    : KJJ1

    Event time........ 03/19/19 11:07:06.080
    Request Type...... API
    API name.......... catalog_v1.0
    Request URI....... /catalogManager/v1.0/order
    Query String......
    Method............ POST
    Port..............52943
    HTTP code......... 503 (Service Unavailable)
    Timeout...........Yes
    Service Name...... placeOrder_v1.0
    Total Req Time.... 30.001297s
    z/OS Conn Time.... 0.000758s
    SoR Resp Time..... 30.000539s
    SoR ID............ MOPZT00 .CICSMOB1
    SoR Ref........... CICSMOB1
    SoR Resource...... MZPO,DFH0XCMN
    Remote Address.... 9.212.143.65
    Request Length.... 56
    Response Length... 0
    Correlator........ e9e3f0f0d7d3c5e70025400019
    Operation......... postPlaceOrder_v1.0
    Provider.......... CICS-1.0
    User ID........... EMPLOY1
```

This screen shows the details of the request that timed out. It gives a complete view of the timeout:

CICS transaction MPZO timed out and the program that was being executed was DFH0XCMN.

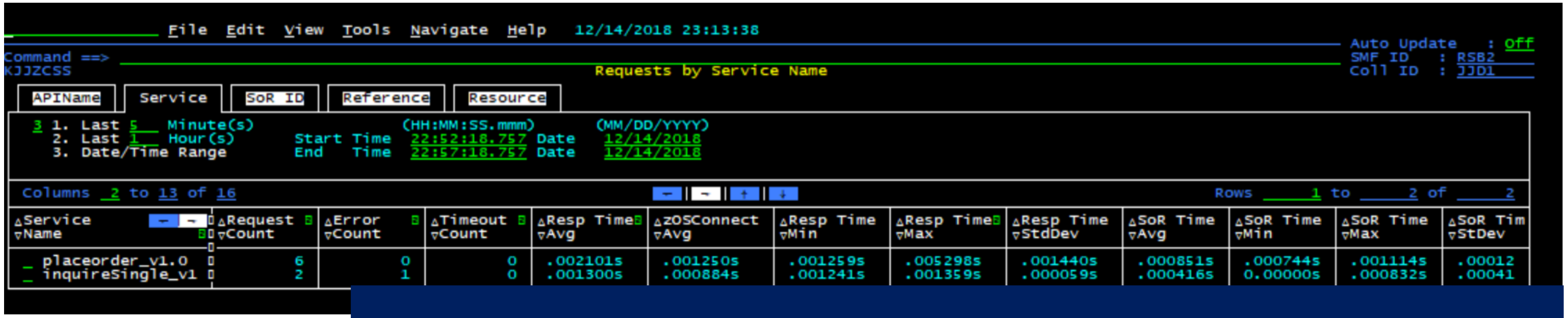
An HTTP return code 200 was returned to the client.

We have enough data to pass on to the CICS SME for final analysis.

Select a specific API request to validate overall request performance

Scenario: Determine z/OS Connect EE API Performance Issues

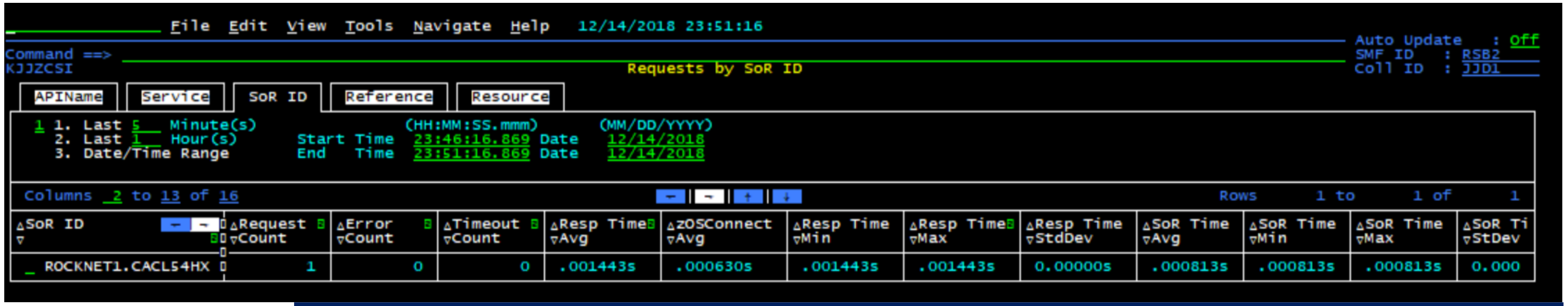
Tab through to change order perspective – by API/Service



```
_________________ File  Edit  View  Tools  Navigate  Help   12/14/2018 23:13:38
                                                                                      Auto Update   : Off
Command ==>                                                                           SMF ID   : RSB2
KJJZCSS                                         Requests by Service Name              Coll ID  : JJD1

 APIName | Service | SoR ID | Reference | Resource

 3 1. Last 5__  Minute(s)            (HH:MM:SS.mmm)      (MM/DD/YYYY)
   2. Last 1__  Hour(s)   Start Time  22:52:18.757 Date   12/14/2018
   3. Date/Time Range     End   Time  22:57:18.757 Date   12/14/2018

 Columns  2 to 13 of 16                                                  Rows    1 to    2 of    2
 ΔService         ΔRequest  ΔError    ΔTimeout  ΔResp Time ΔzOSConnect ΔResp Time ΔResp Time ΔResp Time ΔSoR Time  ΔSoR Time  ΔSoR Time  ΔSoR Tim
 ∇Name            ∇Count    ∇Count    ∇Count    ∇Avg       ∇Avg        ∇Min       ∇Max       ∇StdDev    ∇Avg       ∇Min       ∇Max       ∇StDev
 _ placeorder_v1.0        6         0         0  .002101s   .001250s    .001259s   .005298s   .001440s   .000851s   .000744s   .001114s   .00012
 _ inquireSingle_v1       2         1         0  .001300s   .000884s    .001241s   .001359s   .000059s   .000416s   0.00000s   .000832s   .00041
```

Use the Service tab to view the list of defined services…

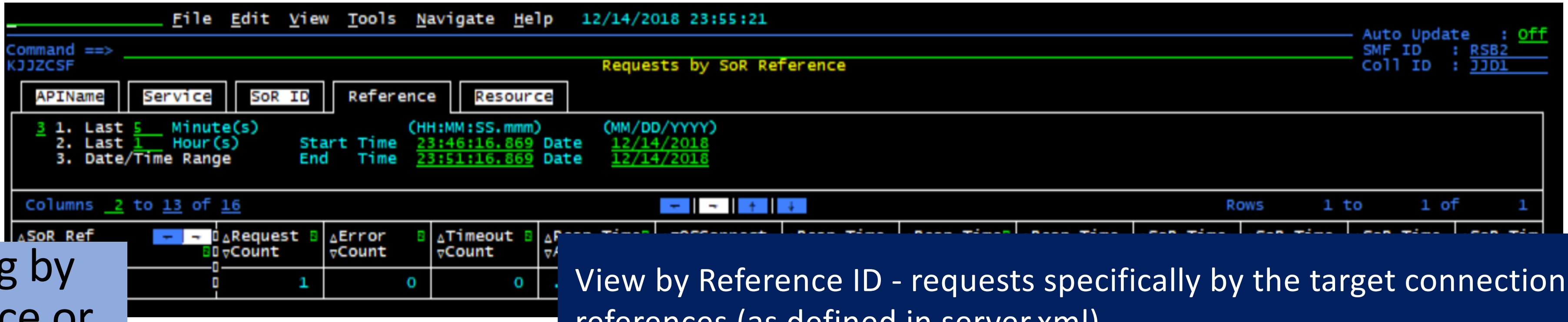
Look at the data passing through z/OS Connect in form other than API Name



```
_________________ File  Edit  View  Tools  Navigate  Help   12/14/2018 23:51:16
                                                                                      Auto Update   : Off
Command ==>                                                                           SMF ID   : RSB2
KJJZCSI                                         Requests by SoR ID                    Coll ID  : JJD1

 APIName | Service | SoR ID | Reference | Resource

 1 1. Last 5__  Minute(s)            (HH:MM:SS.mmm)      (MM/DD/YYYY)
   2. Last 1__  Hour(s)   Start Time  23:46:16.869 Date   12/14/2018
   3. Date/Time Range     End   Time  23:51:16.869 Date   12/14/2018

 Columns  2 to 13 of 16                                                  Rows    1 to    1 of    1
 ΔSoR ID          ΔRequest  ΔError    ΔTimeout  ΔResp Time ΔzOSConnect ΔResp Time ΔResp Time ΔResp Time ΔSoR Time  ΔSoR Time  ΔSoR Time  ΔSoR Ti
 ∇                ∇Count    ∇Count    ∇Count    ∇Avg       ∇Avg        ∇Min       ∇Max       ∇StdDev    ∇Avg       ∇Min       ∇Max       ∇StDev
 _ ROCKNET1.CACL54HX      1         0         0  .001443s   .000630s    .001443s   .001443s   0.00000s   .000813s   .000813s   .000813s   0.000
```

Select System of Record ID tab to view which Subsystems (CICS, IMS etc) are processing API requests and if there were any errors.
This example shows the qualified APPLID for a CICS region

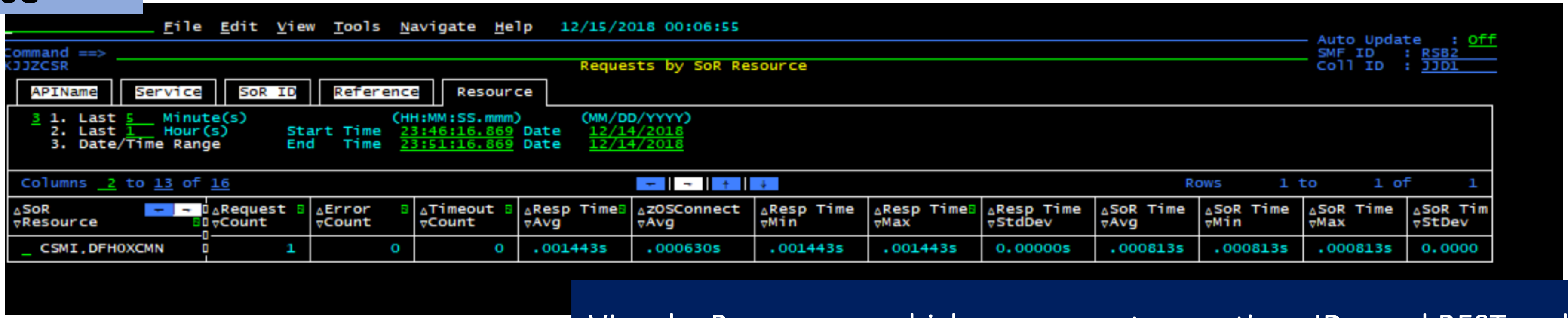
Scenario: Determine z/OS Connect EE API Performance Issues



```
_____________ File  Edit  View  Tools  Navigate  Help   12/14/2018 23:55:21
                                                                        Auto Update   : Off
Command ==>                                                             SMF ID    : RSB2
KJJZCSF                         Requests by SoR Reference               Coll ID   : JJD1
 APIName   Service   SoR ID   Reference   Resource
 3 1. Last 5   Minute(s)           (HH:MM:SS.mmm)    (MM/DD/YYYY)
   2. Last 1   Hour(s)      Start Time 23:46:16.869 Date 12/14/2018
   3. Date/Time Range       End   Time 23:51:16.869 Date 12/14/2018

 Columns  2 to 13 of 16                                    Rows      1 to      1 of      1
 ΔSoR Ref                ΔRequest   ΔError    ΔTimeout   ΔR
                         ∇Count     ∇Count    ∇Count     ∇A
                                1         0          0   .
```

Ordering by Reference or Resource

View by Reference ID - requests specifically by the target connection references (as defined in server.xml)



```
_____________ File  Edit  View  Tools  Navigate  Help   12/15/2018 00:06:55
                                                                        Auto Update   : Off
Command ==>                                                             SMF ID    : RSB2
KJJZCSR                         Requests by SoR Resource                Coll ID   : JJD1
 APIName   Service   SoR ID   Reference   Resource
 3 1. Last 5   Minute(s)           (HH:MM:SS.mmm)    (MM/DD/YYYY)
   2. Last 1   Hour(s)      Start Time 23:46:16.869 Date 12/14/2018
   3. Date/Time Range       End   Time 23:51:16.869 Date 12/14/2018

 Columns  2 to 13 of 16                                    Rows      1 to      1 of      1
 ΔSoR            ΔRequest  ΔError   ΔTimeout  ΔResp Time ΔzOSConnect ΔResp Time ΔResp Time ΔResp Time ΔSoR Time ΔSoR Time ΔSoR Time ΔSoR Tim
 ∇Resource       ∇Count    ∇Count   ∇Count    ∇Avg       ∇Avg        ∇Min       ∇Max       ∇StdDev    ∇Avg      ∇Min      ∇Max      ∇StDev
 _ CSMI.DFHOXCMN        1        0         0  .001443s   .000630s    .001443s   .001443s   0.00000s   .000813s  .000813s  .000813s  0.0000
```

View by Resources - which programs, transactions IDs, and REST end points are being called by z/OS Connect to satisfy each API request.

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Collector **performance** improvements

Improved Garbage Collection Option

- New OMEGAMON JVMTI agent for Garbage Collection
  - Default (Health Center) requires moderate level of activity before triggering a report
  - New JVMTI agent Allows garbage collection for low-usage running JVMs

Collector Performance Improvements

- Reduced number of service calls
- Virtual memory statistics collected on-demand
- Collect only locks utilized vs acquired and released

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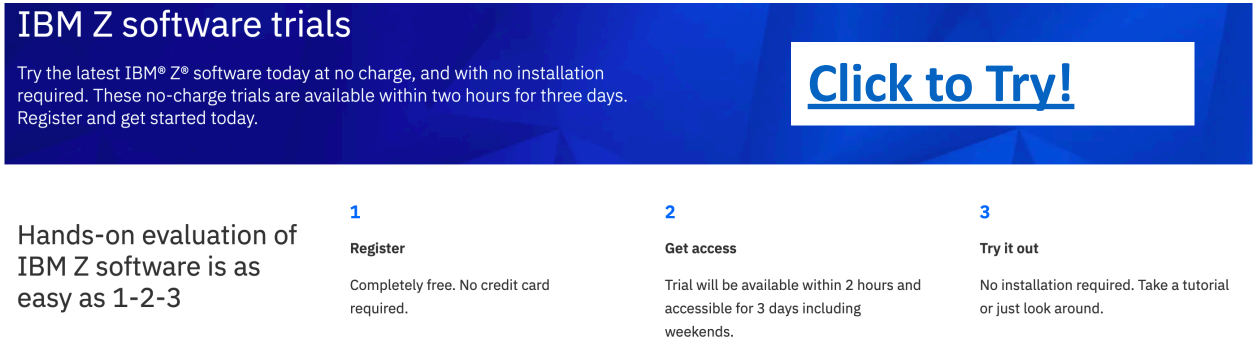

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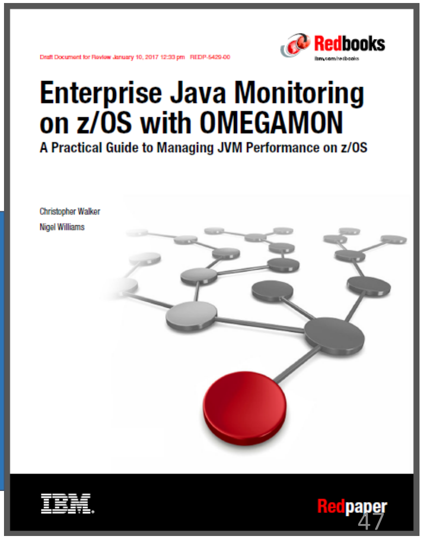

Draft Document for Review January 10, 2017 12:33 pm REDP-5429-00

Enterprise Java Monitoring on z/OS with OMEGAMON

A Practical Guide to Managing JVM Performance on z/OS

Christopher Walker

Nigel Williams

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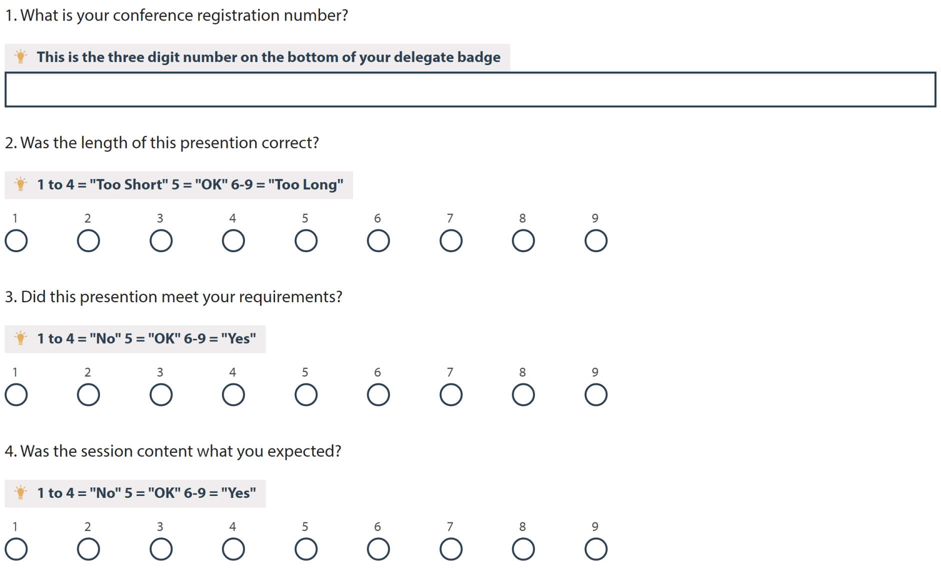

1. What is your conference registration number?

This is the three digit number on the bottom of your delegate badge

2. Was the length of this presention correct?

1 to 4 = "Too Short" 5 = "OK" 6-9 = "Too Long"

1	2	3	4	5	6	7	8	9
○	○	○	○	○	○	○	○	○

3. Did this presention meet your requirements?

1 to 4 = "No" 5 = "OK" 6-9 = "Yes"

1	2	3	4	5	6	7	8	9
○	○	○	○	○	○	○	○	○

4. Was the session content what you expected?

1 to 4 = "No" 5 = "OK" 6-9 = "Yes"

1	2	3	4	5	6	7	8	9
○	○	○	○	○	○	○	○	○

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