



Discovering Clear Useful Insights into z/OS Connect and JVM Applications on Z

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Prefix

As customers look to connect their existing Z applications to the cloud, applications are increasing their reliance on **z/OS Connect EE** and **Java Virtual Machines on z/OS**.

This presentation will illustrate how to provide clear and useful insights on how to improve performance and reliability for these new application environments.



Agenda

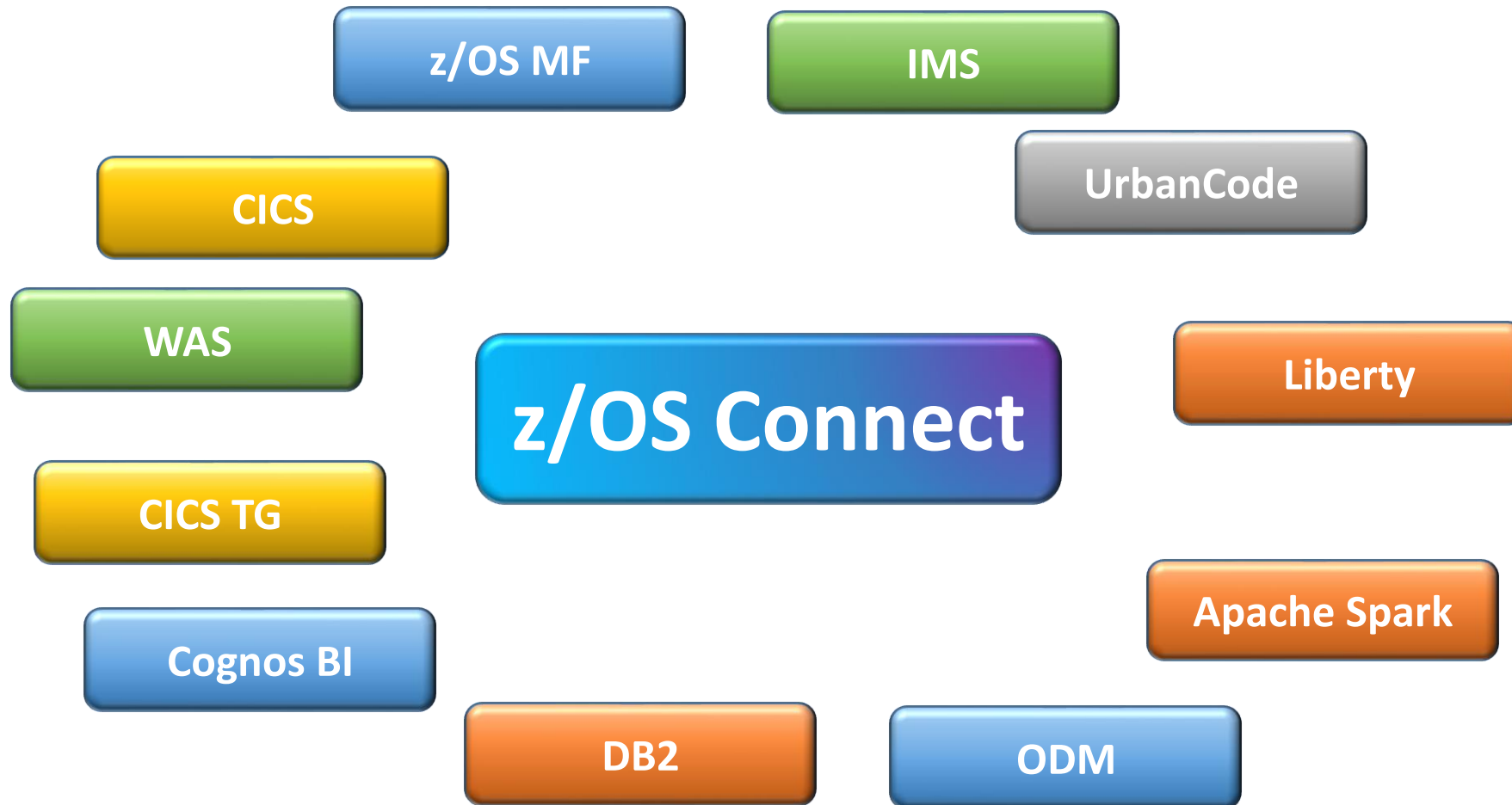


- Resource Monitoring of JVM on z/OS
- Introduction to OMEGAMON for JVM
- Live Demo of managing z/OS JVM applications

- Overview of z/OS Connect and request APIs.
- Custom z/OS Connect Application for Demo
- Live Demo of z/OS Connect scenarios

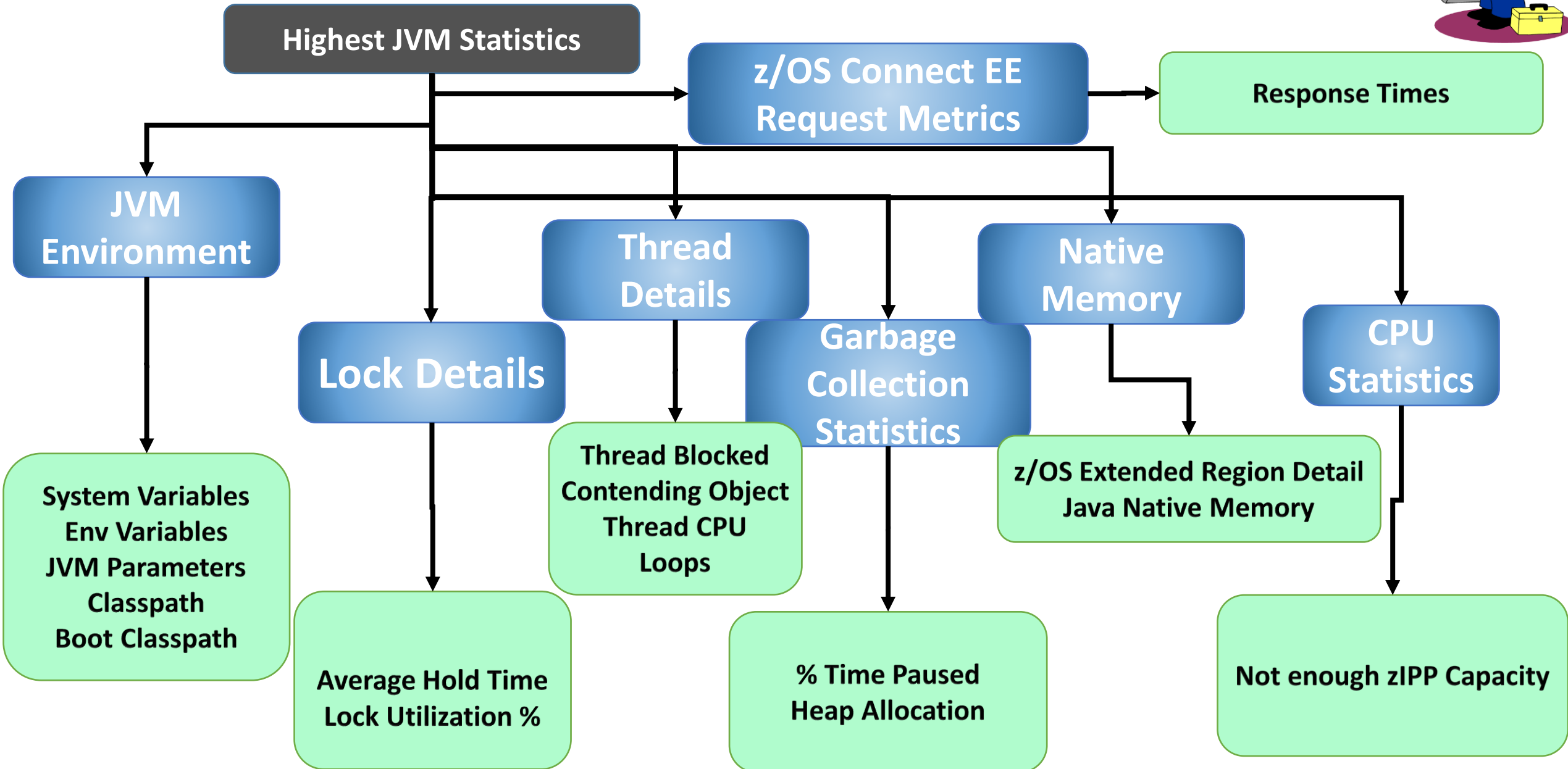


Java on z/OS Applications

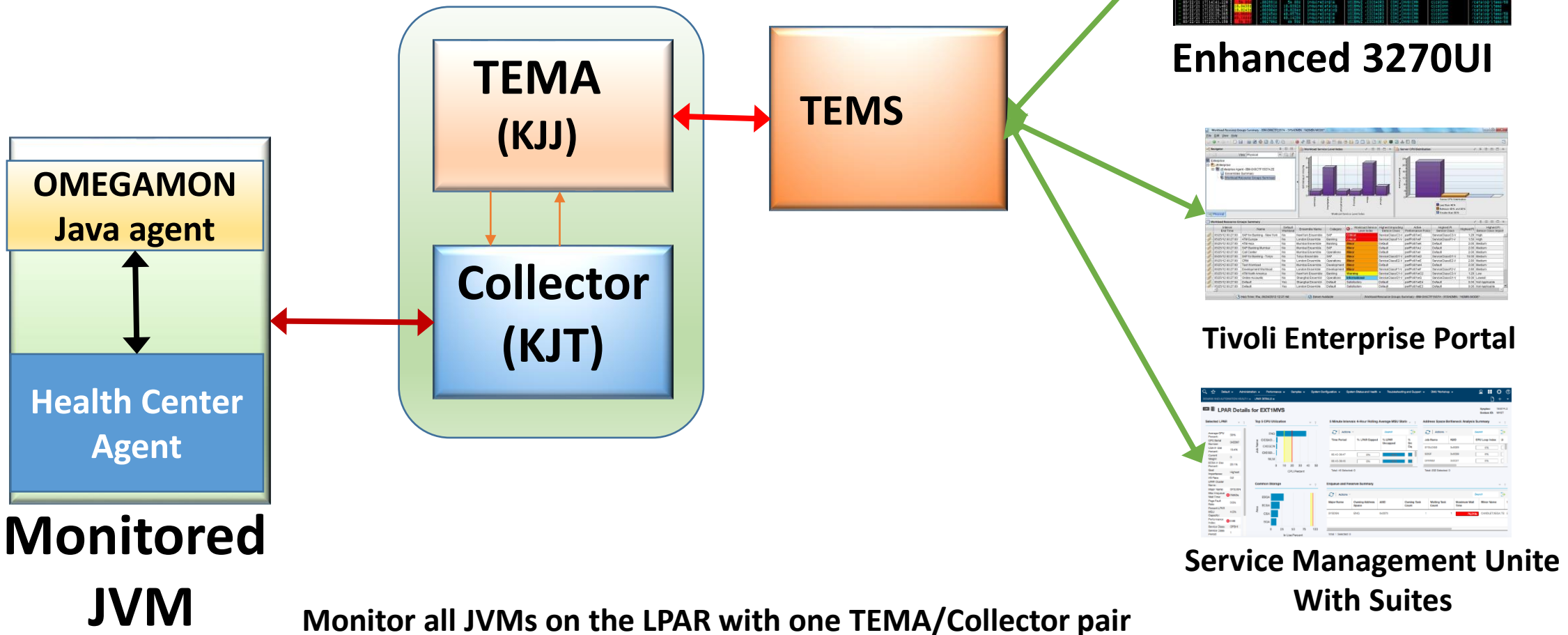


- Auto-discovers all online Java[®] Virtual Machines on z/OS
- Enable only JVM you want to monitor

Key Metrics

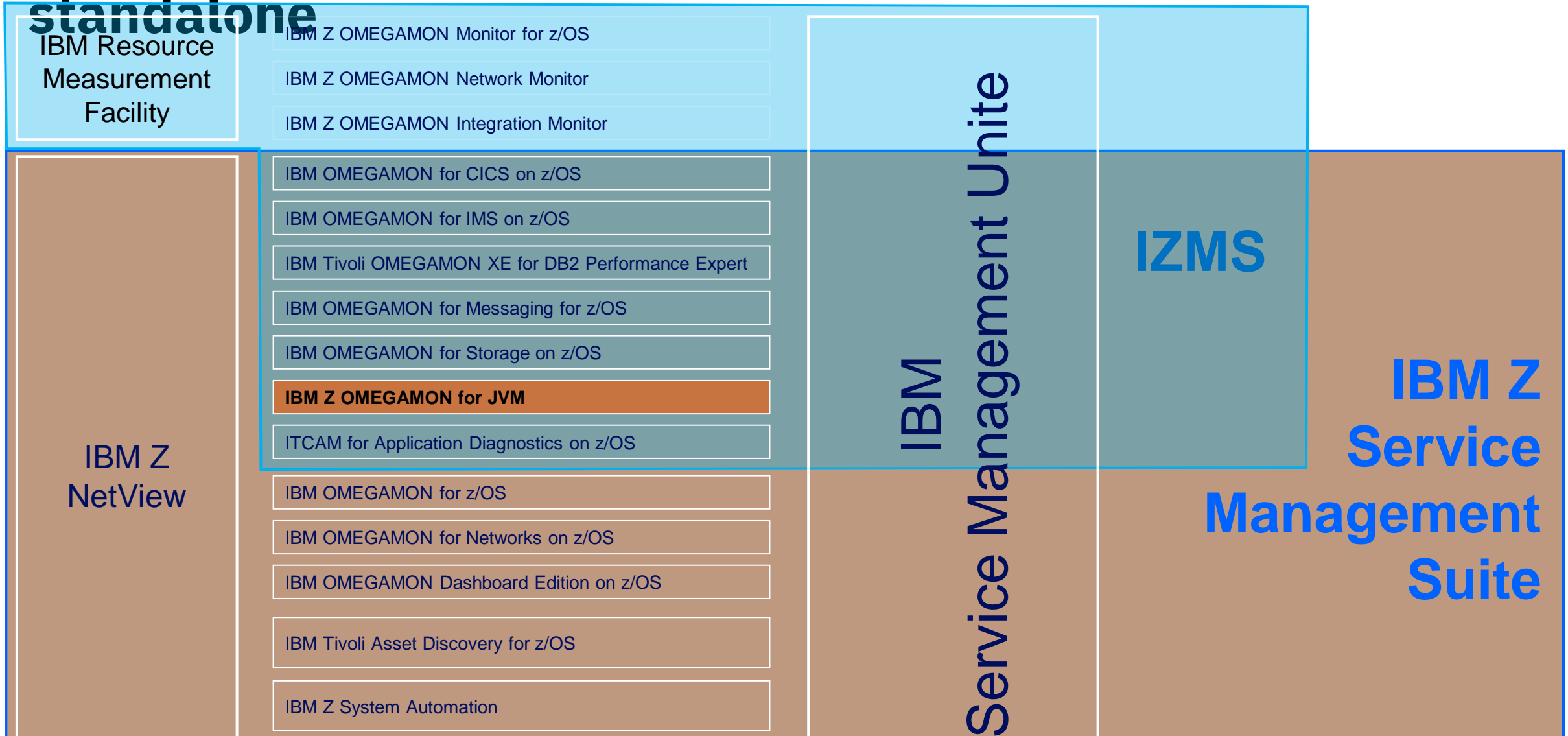


OMEGAMON for JVM on z/OS Components



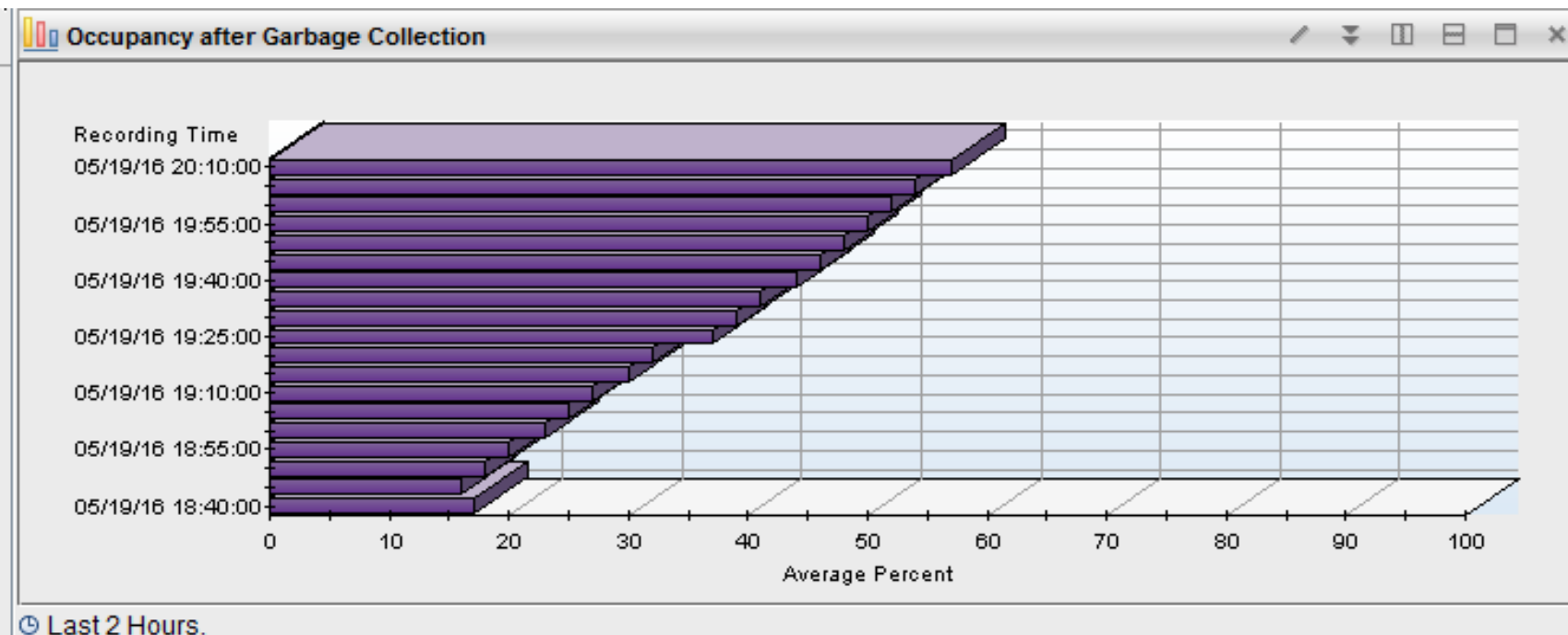
Monitor all JVMs on the LPAR with one TEMA/Collector pair

IBM Z OMEGAMON for JVM offered in Suites or standalone



IBM Z OMEGAMON Runtime Edition for JVM

Scenario: Identify Possible Memory Leak example



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: Identifying Locks and Thread Blocks

File Edit View Tools Navigate Help 10/03/2016 16:42:54

Auto Update : Off

Command ==>

SMF ID : SYS

KJJTHD

Thread Statistics

Coll ID : JJNW

Job Name: NWILL4

Columns 2 to 8 of 8

Rows 1 to 13 of 28

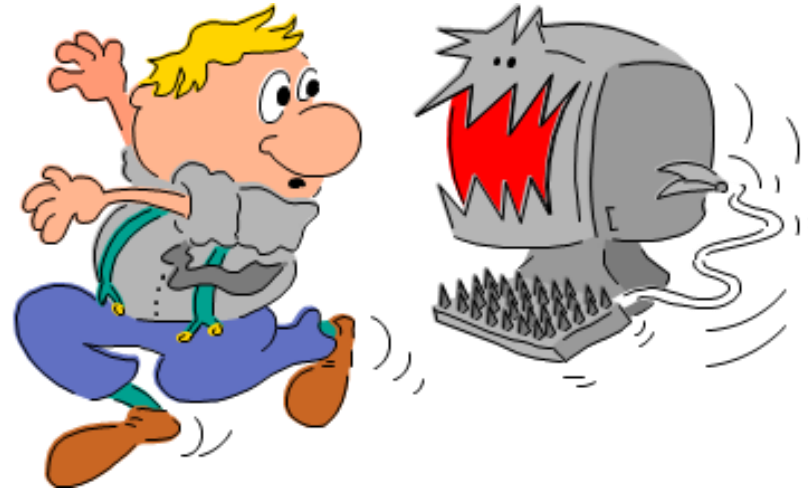
Thread Name	State	Contending Object	Contending Thread Name	Monitors Owned	ΔCPU %	ΔCPU Time	+Stack Trace
_ Query8	BLOCKED	com.bank.web.Acc	Query0@12	0	0.00%	0.000s	com.ban
_ Query9	BLOCKED	com.bank.web.Acc	Query0@12	0	0.00%	0.000s	com.ban
_ Query4	BLOCKED	com.bank.web.Acc	Query0@12	0	0.00%	0.000s	com.ban
_ 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	null	null	0	0.00%	0.000s	null
_ Signal Dispatcher	RUNNABLE	null	null	0	0.00%	0.001s	com.ibm
_ Finalizer thread	RUNNABLE	null	null	0	0.00%	0.005s	null

BACK HOME

Hub NVWSYSG.CMS on platform SYS(z/OS)

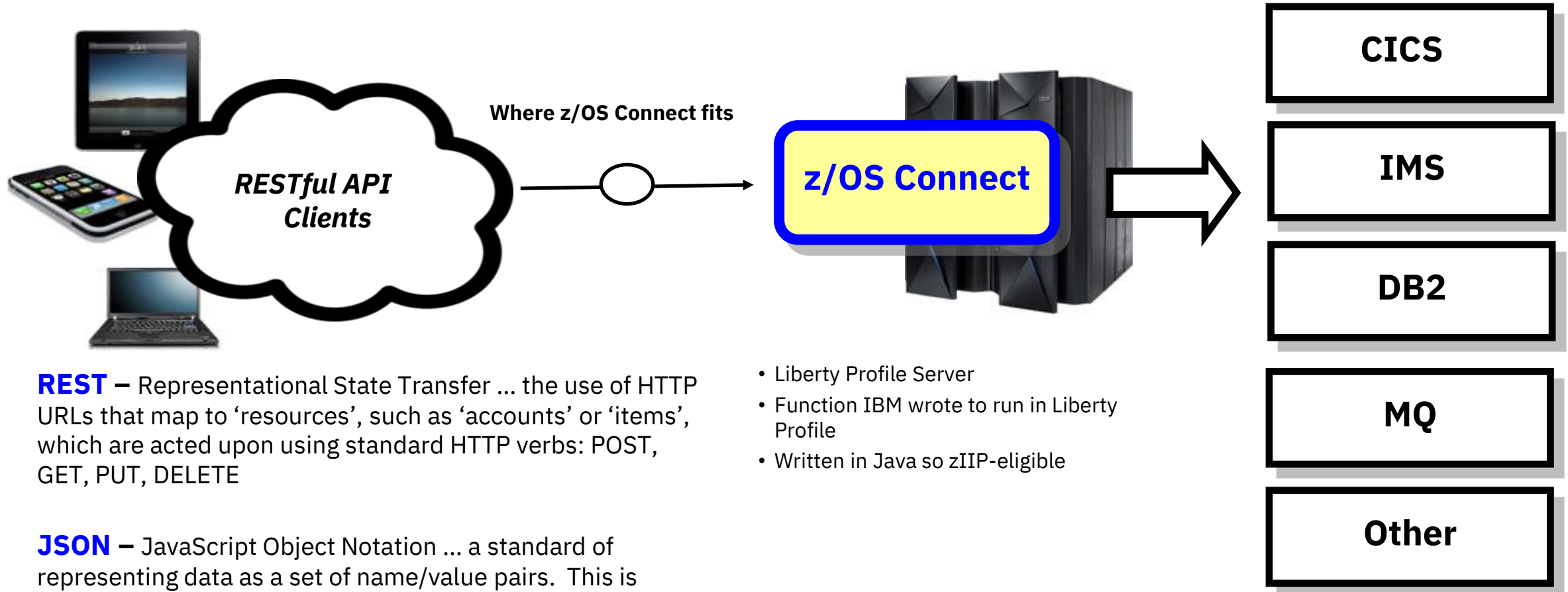
Thread Statistics drills-down to all active threads making BLOCKED threads easy to spot.

Demo: Monitoring z/OS JVMs



z/OS Connect – Setting Context

This is about getting REST and JSON into your mainframe environment in a way that enables you to best take advantage of the assets that exist there:

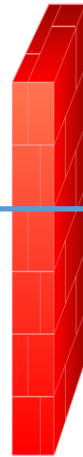


REST – Representational State Transfer ... the use of HTTP URLs that map to ‘resources’, such as ‘accounts’ or ‘items’, which are acted upon using standard HTTP verbs: POST, GET, PUT, DELETE

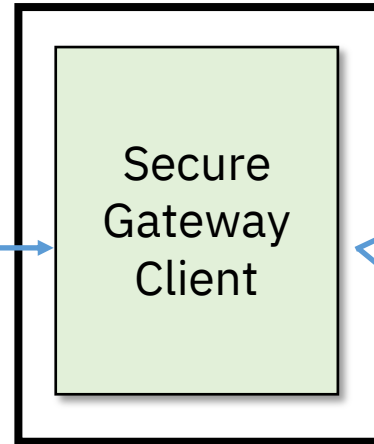
JSON – JavaScript Object Notation ... a standard of representing data as a set of name/value pairs. This is passed back and forth along with REST request/responses

- Liberty Profile Server
- Function IBM wrote to run in Liberty Profile
- Written in Java so zIIP-eligible

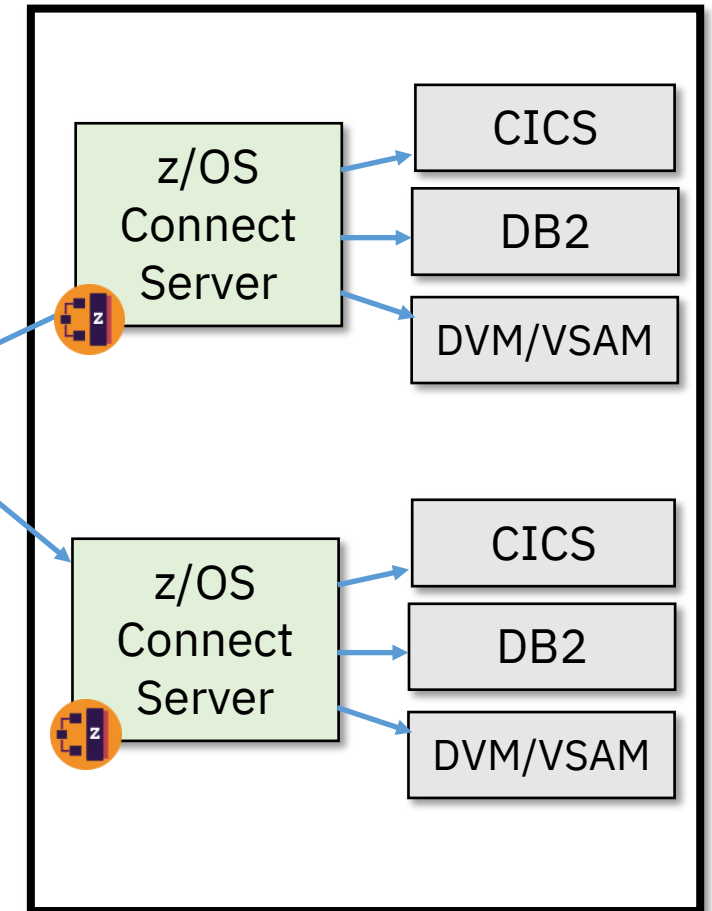
Mobile Device Inventory Application Topology



z Linux
(Ubuntu 18.04)



z/OS LPAR



CICS Catalog Manager application



- COBOL/VSAM
- Callable Interface
 - Commarea or
 - Channels/Containers
- 2 functions:
 - inquireCatalog
 - inquireSingle

```
CICS EXAMPLE CATALOG APPLICATION - Main Menu
Select an action, then press ENTER
Action . . . . 1. List Items
                2. Order Item Number
```

```
CICS EXAMPLE CATALOG APPLICATION - Inquire Catalog
Select a single item to order with /, then press ENTER
Item      Description                                Cost      Order
-----
0010     Nexus S                                692.90      -
0020     DROID Pro by Motorola                    557.90      -
0030     DROID 2 Global by Motorola                 759.90      /
0040     LG Axis                                450.00      -
0050     Motorola
```

```
CICS EXAMPLE CATALOG APPLICATION - Details of your order
Enter order details, then press ENTER
Item      Description                                Cost      Stock      On Order
-----
0030     DROID 2 Global by Motorola                 759.90      0003      000
Order Quantity: _____
User Name: _____
Charge Dept: _____
```

z/OS Connect API Calls return JSON data



inquireCatalog:

```
CICS EXAMPLE CATALOG APPLICATION - Inquire Catalog
Select a single item to order with /, then press ENTER

Item  Description                Cost  Order
-----
0010  Nexus S                        692.90  -
0020  DROID Pro by Motorola          557.90  -
0030  DROID 2 Global by Motorola     759.90  /
0040  LG Axis                         450.90  -
0050  Motorola BRAVO                 761.78  -
0060  Motorola CHARM                 785.89  -
0070  Motorola ATRIX                 567.44  -
0080  Motorola DEFY                  753.54  -
0090  Motorola XOOM                  345.35  -
0100  Samsung Galaxy Tab             654.35  -
0110  Samsung GEM                    754.56  -
0120  Samsung Mesmerize              565.99  -
0130  Sanyo Zio                       768.85  -
0140  Samsung Transform              865.89  -
0150  Samsung Showcase               865.35  -

F3=EXIT  F7=BACK  F8=FORWARD  F12=CANCEL
```

→ /catalog/items?startItemID=0010 →

```
{
  "cics_cat_resp": {
    "inquire_request": {
      "cat_item": [
        {
          "itemID": 10,
          "cost": "692.90",
          "onOrder": 0,
          "description": "Nexus S",
          "department": 10,
          "in_stock": 0
        },
        {
          "itemID": 20,
          "cost": "557.90",
          "onOrder": 50,
          "description": "DROID Pro by Motorola",
          "department": 10,
          "in_stock": 0
        },
        {
          "itemID": 30,
          "cost": "759.90",
          "onOrder": 0,
          "description": "DROID 2 Global by Motorola",
          "department": 10,
          "in_stock": 3
        },
        {
          "itemID": 40,
          "cost": "450.90",
          "onOrder": 0,
          "description": "LG Axis",
          "department": 10,
          "in_stock": 47
        },
        {
          "itemID": 50,
          "cost": "761.78",
          "onOrder": 0,
          "description": "Motorola BRAVO",
          "department": 10,
          "in_stock": 48
        }
      ]
    }
  }
}
```

inquireSingle:

```
CICS EXAMPLE CATALOG APPLICATION - Details of your order
Enter order details, then press ENTER

Item  Description                Cost  Stock  On Order
-----
0030  DROID 2 Global by Motorola     759.90  0003  000

Order Quantity: ___
User Name: _____
Charge Dept: _____

F3=EXIT  F12=CANCEL
```

→ /catalog/items/30 →

```
{
  "cics_single_resp": {
    "inquire_single": {
      "single_item": {
        "itemID": 30,
        "cost": "759.90",
        "on_order": 0,
        "description": "DROID 2 Global by Motorola",
        "department": 10,
        "in_stock": 3
      }
    }
  }
}
```

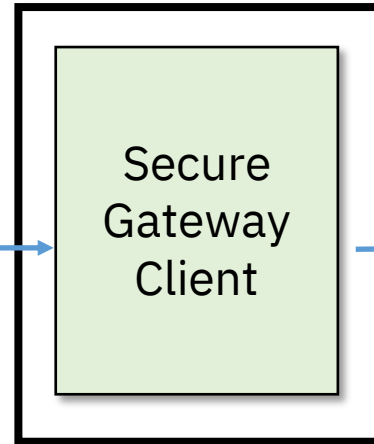
Mobile Device Inventory Application Topology



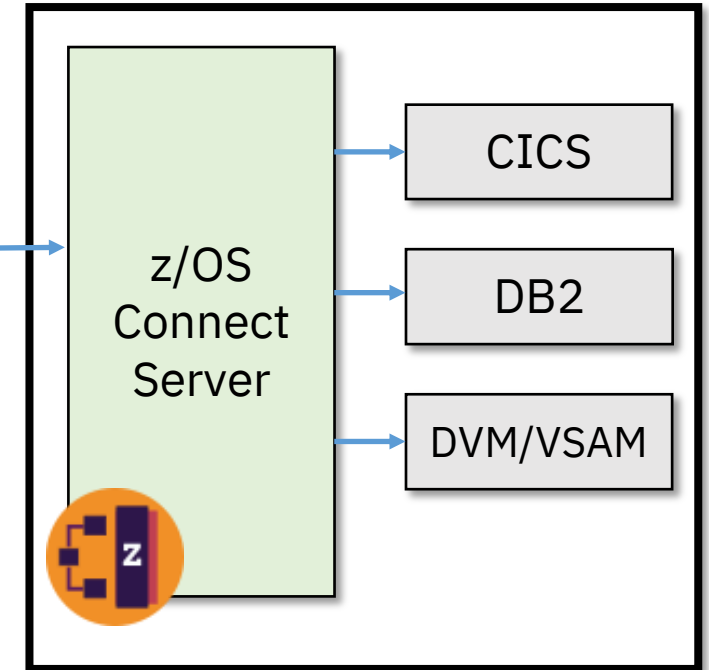
IBM Cloud



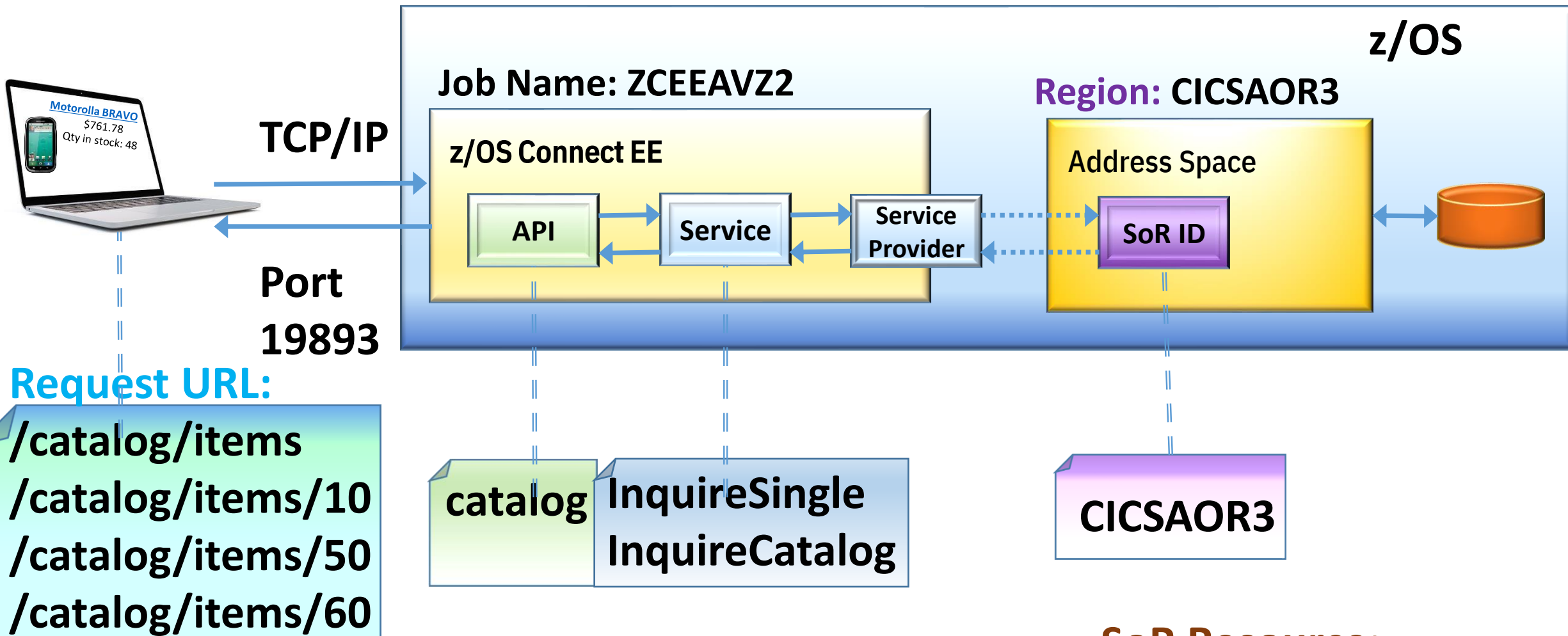
z Linux (Ubuntu 18.04)



z/OS LPAR



z/OS Connect EE API Provider Demo Scenario



System of Record (SoR): z/OS application that provides the API data

SoR Resource: CICS transaction and program name

Service: z/OS Connect EE interface to SoR

SoR Resource:
CICS Transaction: CSMI

z/OS Connect API Response Times

JVMs Monitored by this Collector

Columns 2 to 13 of 16

ΔJob ▽Name	Subsystem Type	Application	ΔGCs per ▽Minute	Δ% Time in ▽GC Pauses	ΔHeap ▽Occupancy	ΔSystem ▽GC Count	ΔLocks ▽Missed %
_ JJD0BGBQ	Liberty	z/OS Connect	0.00	0.00%	0.00%	0	1.00%



File Edit View Tools Navigate Help 12/14/2018 21:26:03

Command ==> JJJZCSA

Auto Update : **off**
SMF ID : RSB2
Coll ID : JJD1

z/OS Connect Request Summary

APIName	Service	Sor ID	Reference	Resource								
1. Last <u>5</u> Minute(s) (HH:MM:SS.mmm) (MM/DD/YYYY) 2. Last <u>1</u> Hour(s) Start Time <u>21:21:03.705</u> Date <u>12/14/2018</u> 3. Date/Time Range End Time <u>21:26:03.705</u> Date <u>12/14/2018</u>												
Columns <u>3</u> to <u>13</u> of <u>17</u> Rows <u>1</u> to <u>3</u> of <u>3</u>												
ΔAPI ▽Name	ΔHTTP ▽Method	ΔRequest ▽Count	ΔError ▽Count	ΔTimeout ▽Count	ΔResp Time ▽Avg	zOSConnect ▽Avg	ΔResp Time ▽Min	ΔResp Time ▽Max	ΔResp Time ▽StdDev	ΔSor Time ▽Avg	ΔSor Time ▽Min	ΔSor Time ▽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

Z/OS Connect to the cause

The screenshot displays z/OS Connect console output. At the top right, the system ID **CICSAOR3** is highlighted in a red box. Below this, a list of system statistics is shown in cyan text on a black background. A red box highlights the CPU Utilization value of 0.0%. Below the statistics, a table titled 'Columns 2 to 14 of 19' is displayed. The table has seven columns: ΔTransaction ID, ΔCPU Time, ΔElapsed Time, Task State, Wait Type, Resource Type, and Resource Name. The first row shows transaction CSKL with a CPU time of 1.96355s (highlighted in red) and an elapsed time of 6d 20h. The second row shows transaction CSMI with a CPU time of .000398s and an elapsed time of 27.6958s (highlighted in red). The third row shows transaction CSMI with a CPU time of .000382s and an elapsed time of 30.8168s (highlighted in red). The Task State for the second and third rows is 'Suspend', and the Wait Type is 'Interval'. The Resource Type for the second and third rows is 'ICWAIT' (highlighted in red), and the Resource Name is 'L8004'.

ΔTransaction ID	ΔCPU Time	ΔElapsed Time	Task State	Wait Type	Resource Type	Resource Name
CSKL	1.96355s	6d 20h	Running	CPU Interval	OPEN_TCB	L8004
CSMI	.000398s	27.6958s	Suspend	Interval	ICWAIT	L8004
CSMI	.000382s	30.8168s	Suspend	Interval	ICWAIT	L8004

The z/OS Connect Response time issue identified **CICSAOR3** and transaction **CSMI**.

Looking at the CICS Transaction

```
File Edit View Tools Navigate Help 03/23/2021 16:27:19
Command ==>
KCPTASD
Details for Transaction CSMI Task
Details Statistics Storage Timings I/O Definitions
Transaction Details
Transaction ID..... CSMI Time in
CPU Time..... .000448s Elapsed
Storage Used Above 16M..... 106K Storage
Attach time..... 16:23:32 Time of
Suspend Timeout Due..... None Facility
Facility ID..... n/a Task Sta
Dispatcher Queue..... TXN mstr First Pr
Current Program ID..... DNV0XVDS Resource
Resource Name..... User ID.
EXEC CICS Command..... DELAY Purgeabl
Purge Status..... No purge Suspend
UOW State..... Inflight Umbrella
Originating Transaction ID..... CSMI Trace ac
EIB Details
EXEC CICS Command..... DELAY Function
EIBRESP Description..... NORMAL EIBRESP
EIBRESP2 Value..... 0 Resource
EIB Date and Time..... 16:23:32 Program
Program Offset..... 00000F4A Terminal
```

CICS Region is ZCEEAV2

Finally, we see the EXEC CICS command was a **DELAY in DNV0XVDS !**

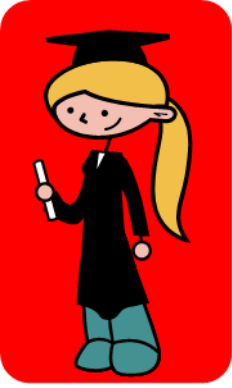
The transaction ID is CSMI

We discovered the current Program is DNV0XVDS

Demo: Monitoring z/OS Connect



Summary



OMEGAMON for JVM delivers clear insights into z/OS Connect EE and Java Virtual Machine applications.

- Discovery of all online z/OS JVMs
- Proactive Resource monitoring for JVMs on z/
- Robust Monitoring of z/OS Connect
 - Follow requests Real time and History
 - API Response Times



Continuous Delivery of new functions

Delivery of major new functions through PTFs

- Documented online

[NEW WITH OMEGAMON for JVM V5.4](#)

PTF December 2016

PTF March 2018

PTF February 2019

[New with OMEGAMON V5.5](#)

- **Runtime Edition for JVM**
- **Performance Improvements**
- **Completed Job History**

Fix Pack 1 August 2020

Fix Pack 2, January 2021

- **API Requesters in addition to providers**
- **Real time in-Flight API Monitoring**

Additional information



- Overview: <https://www.ibm.com/products/z-omegamon-for-jvm>
- Free Trial www.ibm.biz/ibmztrial
- YouTube Direct Link: https://youtu.be/QcqnD_B3xsg
- Redbook: <http://www.redbooks.ibm.com/abstracts/redp5429.html?Open>