IBM **Z**

Customer Experiences:

Monitoring and Managing z/VM, Linux on z Systems and LinuxONE

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Agenda

- What does “managing” include?
  - What tools or products can you use?
- Customer scenarios
  - Operational monitoring and automation
  - Performance monitoring
  - Backup and recovery
- Summary and reference information

Agenda

- A little fun
- What does “managing” include?
  - What tools or products can you use?
- Customer scenarios
  - Operational monitoring and automation
  - Performance monitoring
  - Backup and recovery
- Summary and reference information

What is “Managing” and What Tools Can I Use?

Administration and Provisioning

Administer Linux guests/servers via GUI

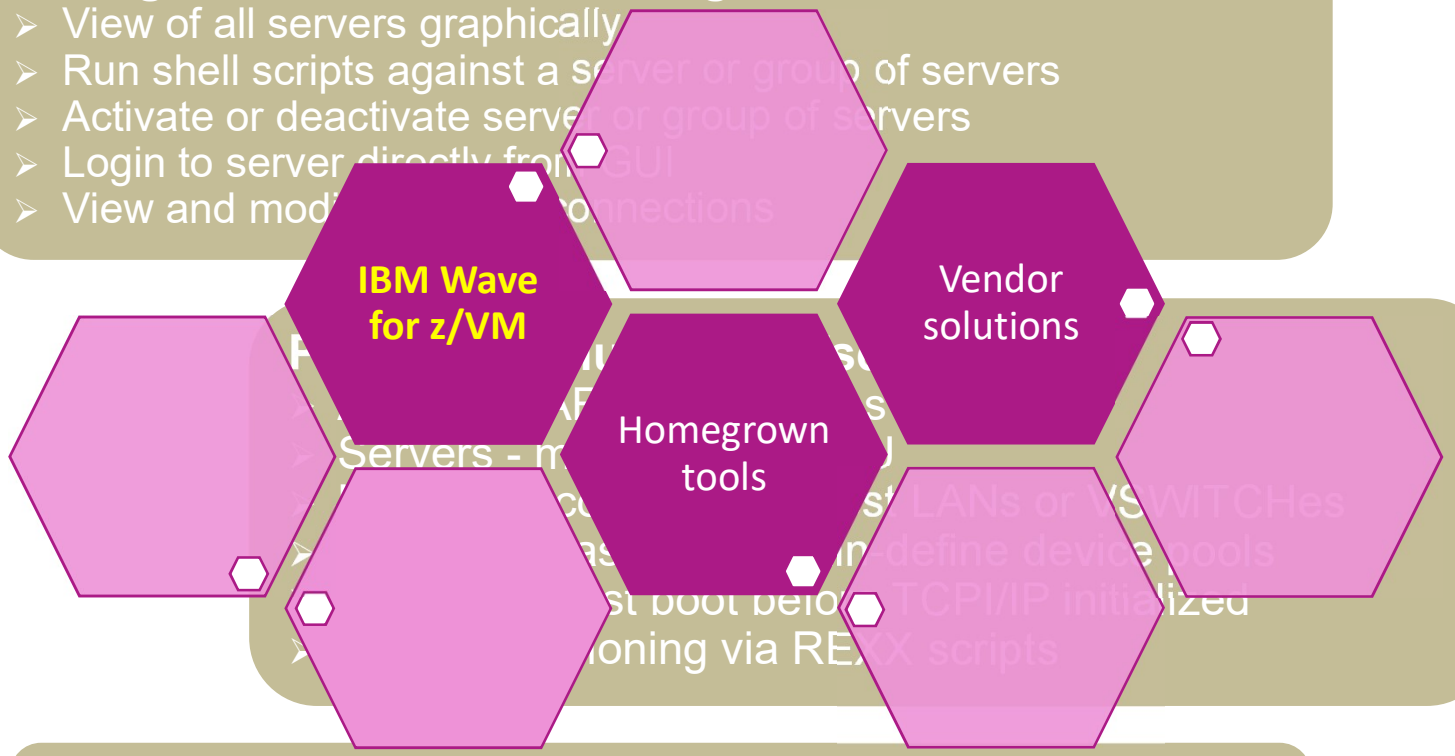
- View of all servers graphically
- Run shell scripts against a server or group of servers
- Activate or deactivate a server or group of servers
- Login to server directly from GUI
- View and modify network connections

Provision Linux guests/servers

- Across LPARs or machines
- Memory and CPU
- Network – connect to Guest LANs or VSWITCHes
- Storage – based on admin-defined device pools
- Customize first boot before TCPI/IP initialized
- Customize cloning via REXX scripts

Administration and Provisioning

Manage and administer Linux guests/servers via GUI
- View of all servers graphically
- Run shell scripts against a server or group of servers
- Activate or deactivate server or group of servers
- Login to server directly from GUI
- View and modify connections



Real time monitoring
- High level view of system status via dashboard gauges
- View storage utilization

Performance Monitoring and Automation

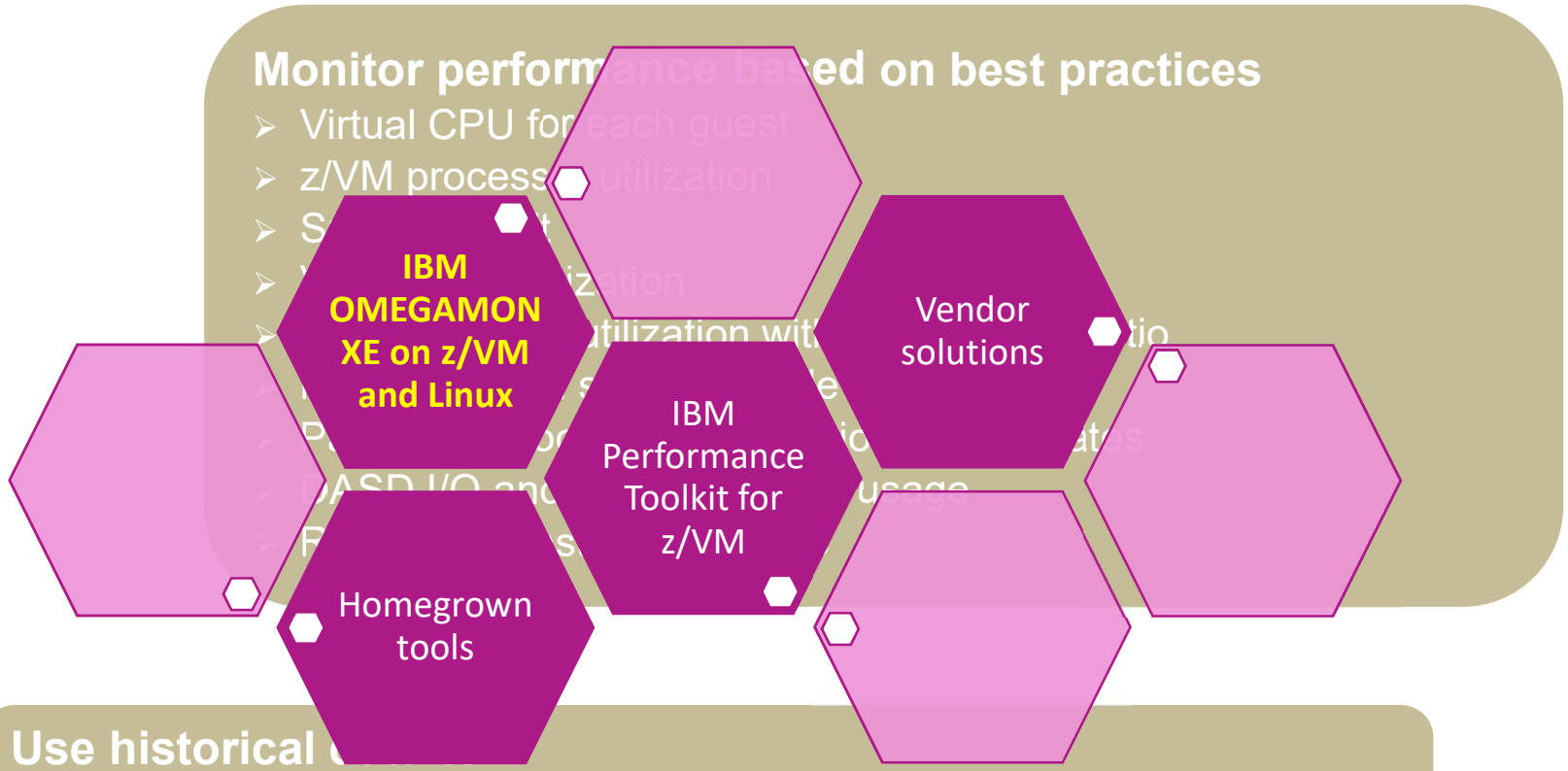
Monitor performance based on best practices

- Virtual CPU for each guest
- z/VM processor utilization
- Spin lock wait
- Virtual disk utilization
- Virtual storage utilization with V/R memory ratio
- Formation and size of eligible list
- Page and spool space utilization and I/O rates
- DASD I/O and minidisk cache usage
- Resource constraint analysis

Use historical data to

- Understand capacity
- Size Linux guests for best performance in a hosted (shared) environment

Performance Monitoring and Automation



Monitor performance based on best practices

- Virtual CPU for each guest
- z/VM process utilization
- S
- V iz ation
- utilization wit tio
- e
- P o io at s
- DASD I/O and usage
- R s

Use historical

- Understand capacity
- Size Linux guests for best performance in a hosted environment

Operational Monitoring and Automation

Console monitoring and viewing

- Operations staff monitoring a central console of alerts
- System programmers debugging a problem on a guest or service machine
- Console log data available for audits or future reference

Gather Data

Generate alerts and/or automatically recover from

- Abend, termination, or error messages
- Service machine disks approaching full
- Critical user IDs or guests being logged off or entering error state
- Spool and/or page space approaching full

React

Schedule automated system maintenance procedures

- Spool cleanup based on policies
- Minidisk cleanup (from logs), including archiving
- Orderly startup and shutdown
  - Relocation of critical guests to another SSI member
- Backups of z/VM system

Prevent

Operational Monitoring and Automation

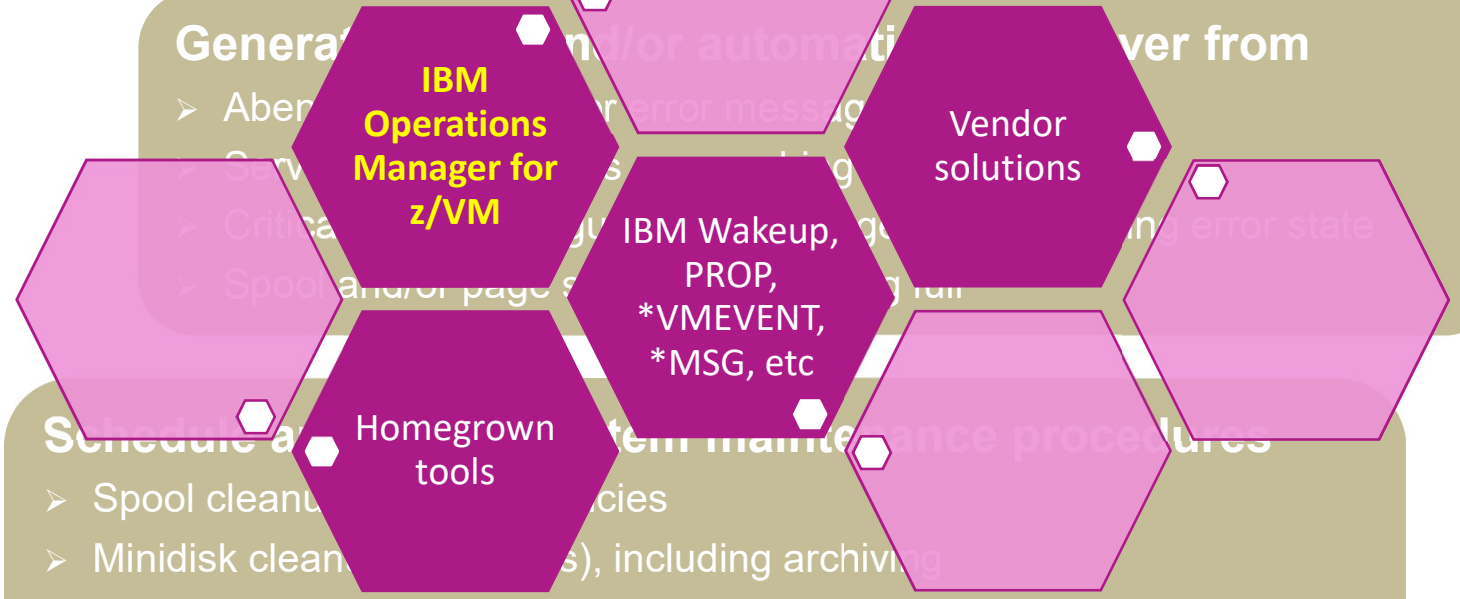
View & issue commands on consoles of Linux guests and CMS service machines

- Operations staff monitoring multiple consoles or a central console of alerts

System programmers debugging a problem on a guest or service machine

Generat **m/or automati** **ver from**

- Aber r error messag
- Serv s g
- Critica gu g error state
- Spool and/or page s g full



Schedule a tem maintenance procedures

- Spool cleanu cies
- Minidisk clean s), including archiving
- Orderly startup and shutdown
  - Relocation of critical guests to another SSI member
- Backups of z/VM system

Backup and Recovery of z/VM and Linux

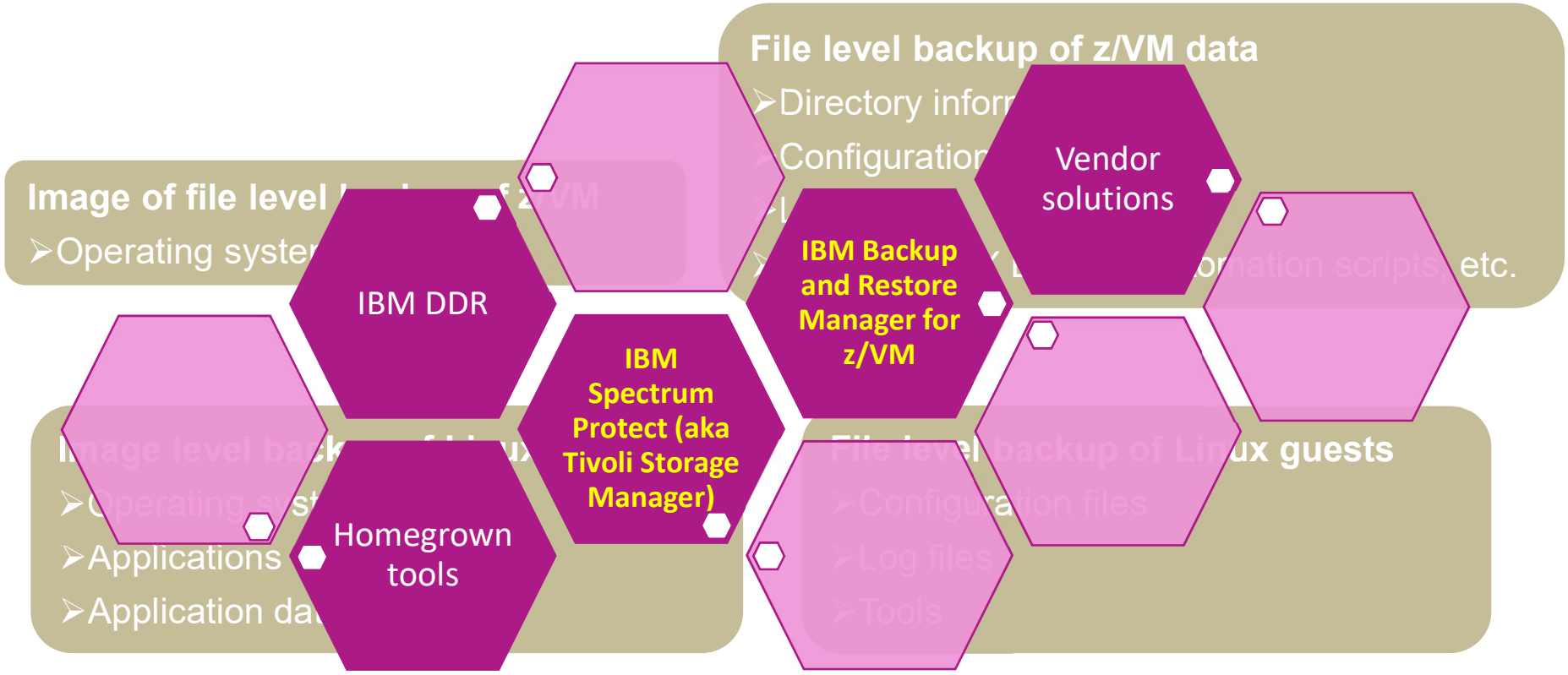
File level backup of z/VM data
- Directory information
- Configuration files
- Log files
- Tools – REXX EXECs, automation scripts, etc.

Image level backup of z/VM
- Operating system

Image level backup of Linux guests
- Operating system
- Applications
- Application data (maybe)

File level backup of Linux guests
- Configuration files
- Log files
- Tools

Backup and Recovery of z/VM and Linux



Complete Solution for administration and management of the z/VM and Linux on z Systems environment

Single PID

5698-IS2 OTC
5698-IS1 Annual S&S

IBM Infrastructure Suite for z/VM and Linux

OMEGAMON XE on z/VM and Linux

Performance monitoring of z/VM and Linux guests

Spectrum Protect (formerly TSM)

File Level backup and recovery for Linux Virtual Machines

IBM Wave for z/VM

Simple, intuitive, graphical z/VM administration tool, including provisioning

Operations Manager for z/VM

Facilitate operational monitoring and automated operations, take action based on events

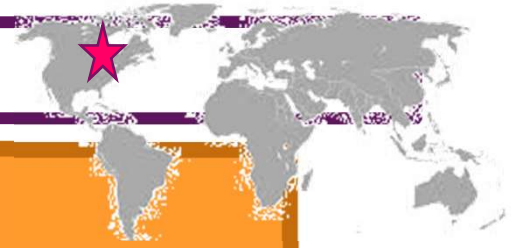
Backup and Restore Manager for z/VM

Image and file level backup and restore of z/VM environment
Image level backup and restore of Linux

Add Tape Manager for z/VM (5697-J08) for customers backing up from z/VM to tape


Customer Scenarios
Operational Monitoring and Automation
Performance Monitoring and Troubleshooting
Backup and Recovery

Error Messages on Linux IPL



The Situation:

- During boot process, Linux file system is **read-only**
- Application needs read/write
  - But sometimes not until hours or days after boot
- Error discovered **hours or days later** when application fails

Operations Manager

Initial solution

Write homegrown tool

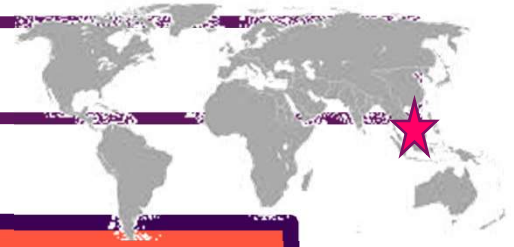
Scan logs on a daily basis looking for error messages

Final solution

Console monitoring tool

Write a rule looking for error message during boot process and take action immediately

Error Message on z/VM IPL



The Situation:

- Error messages on z/VM IPL
- **Reason unknown** to customer (new to z/VM)
- No obvious impact on applications

Operations Manager

Initial solution

None

- Took photo of HMC with smartphone
- Show IBM and ask for help
  - **EREP & Accounting disks full**
- No knowledge of impact

Final solution

Monitoring tool

- Simple monitor setup
- Automatically monitor percent full
- Email someone who can follow documented procedures to save/archive data

Send z/VM and Linux Alerts to z/OS

The Situation:

- Extensive **automation** for **alerts** already running on **z/OS**
  - Automation and operations teams trained there
- Want all **mainframe** alerts to be handled this way
- Need **z/VM** and **Linux** on z alerts **included**

Operations Manager

Initial solution

None

- z/VM and Linux alerts sent via email or to central console only
- Mainframe operations team not able to participate in enterprise solution

Final solution

Monitoring/automation tool

- Trigger alerts for z/VM and Linux events, messages, etc.
- Send via syslog writer to z/OS USS syslog
- Configure USS syslog to send all alerts from z/VM to z/OS syslog
- Enable existing z/OS automation

Coordinate Application Shutdown with z/OS

The Situation:

- **Database on z/OS**
- **Application** server on **Linux** on z
- Shutdown of database necessitates shutdown of application server

Operations Manager

Initial solution

- Manual coordination of shutdown
- Inconvenient for system programmers/operations during non-business hours

Final solution

Console monitoring tools

- System Automation on z/OS sends message to z/VM
- Automation on z/VM triggers application server shutdown
- Automation on z/VM sends message to z/OS when ready

Resource Utilization Reports

The Situation:

- Linux admins misinterpret utilization of their virtual servers
- Overwhelm support with (unnecessary) demands for additional resources
- Sysadmin tools don't show correct breakdown in a virtual server

Initial solution

SysAdmin Tools

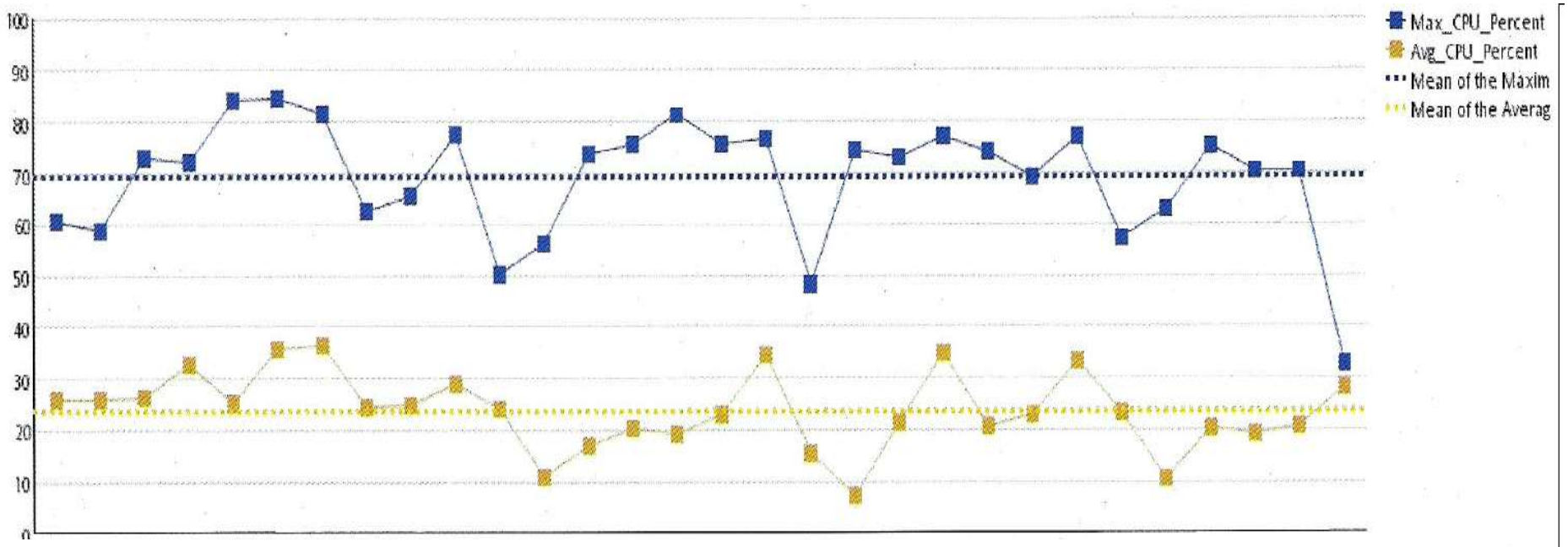
- Tools like TOP and others don't reflect the virtualized environment.
- Users get mixed information and make wrong conclusions.
- Misunderstanding between application owners, Linux admins, and system providers

Final solution

Monitoring tool

- Develop reports
  - CPU utilization max and average
  - Monthly memory utilization breakdown
- Linux admins and application owners satisfied they are getting necessary resources

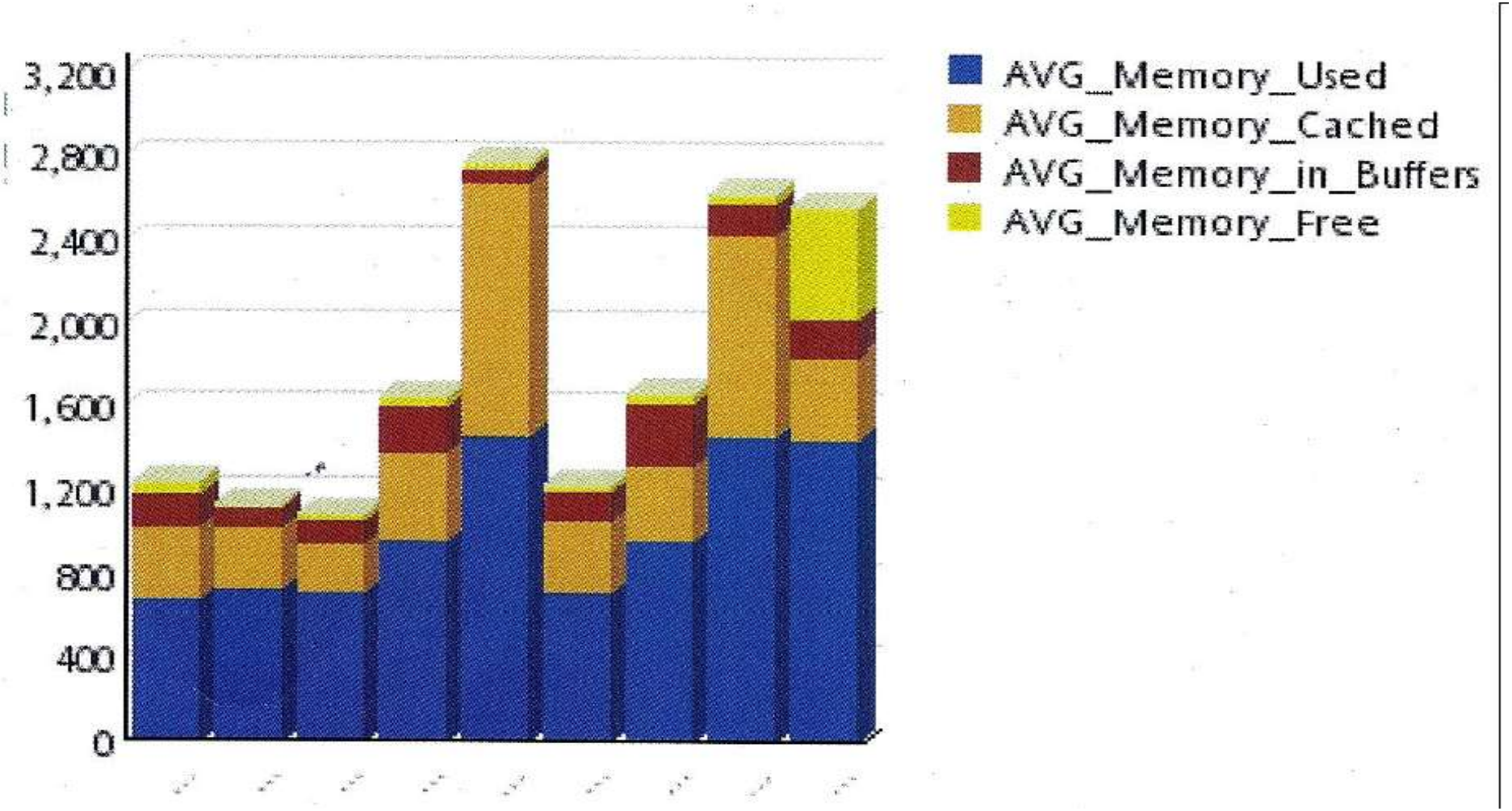
Maximum and Average CPU example



Legend:

Max_CPU_Percent:	Maximum CPU for the day as a percent of the number of virtual CPUs
Avg_CPU_Percent:	Average CPU for the day as a percent of virtual CPUs
Mean of the Maximum:	30 day average for Maximum CPU percentages
Mean of the Averages:	30 day average for the average CPU percentages
AVG_Main_Memory_Util:	Average main memory utilization for the day as a percent
AVG_Cache_Used:	Average size of memory used to cache buffers in megabytes
AVG_Page_Alloc_Rate:	Average number of pages obtained from available list in 4 kilobyte pages per second
AVG_Swap_Used:	The percent of swap space used.

Average Linux Memory Breakdown Example



Stopping and Restarting TCPIP

The Situation:

- Want to "bounce" TCPIP server on z/VM on dev/test system
- No access to HMC or system console
- If issue shutdown or FORCE for TCPIP then lose TN3270 access to system

Operations Manager

Initial solution

Find and coordinate with on-site operations staff who have system console or HMC access

Final solution

Monitoring & automation tool

- Monitor for CP event indicating TCPIP has logged off
- Automatically XAUTOLOG it (after 3-5 seconds)
- Easily bounce TCPIP as needed without relying on operations staff

Shared Monitoring and Automation Across LPARs

The Situation:

- Multiple z/VM LPARs not in same SSI cluster
- Similar monitoring and automation configuration on all LPARs
- Want to share monitoring and automation configuration across LPARS

Operations Manager

Initial solution

Manual processing

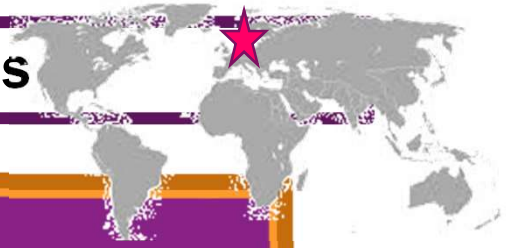
- **Common configuration information maintained on one system**
- **Shared within SSI cluster**
- **Manually copied and reloaded on other LPARs**

Final solution

Automated real-time sharing

- **Shared read/only disk across non-SSI members**
- **Update configuration from single LPAR**
- **Automatically reload on all SSI and non-SSI systems**

Including Performance Data with z/OS Processes



The Situation:

- Collecting **performance data** on z/VM (Performance Toolkit)
- All mainframe performance data processed on **z/OS**
- Want to **include z/VM and Linux** data

Operations Manager

Initial Solution

Manual processing each morning

Login and run commands to

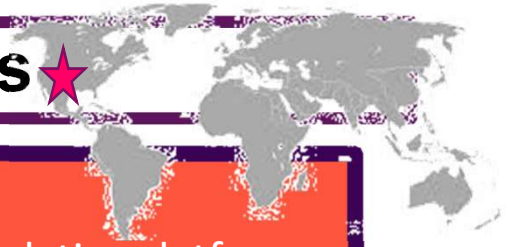
- **Summarize PerfKit data**
- **FTP file to z/OS**
- **Erase file from z/VM**

Final solution

Automated processing overnight

- **Schedule commands to summarize data**
- **When complete, send message to z/OS**
- **z/OS: FTP file from z/VM**
- **z/OS: FTP message to z/VM indicating successful file retrieval**
- **z/VM: erase the file**

Sending Security Messages to Analytics



The Situation:

- Enterprise policy of sending security-related messages to analytics platform
- z/VM logon/logoff and RACF login errors only logged in console log of OPERATOR
- Want z/VM security reporting to be "just like other platforms"

Operations Manager

Initial solution

None

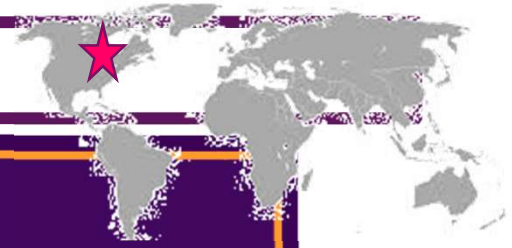
- No analytics and alerting of z/VM RACF-related activity

Final solution

Automation tool

- Automatically capture RACF logon/logoff messages on OPERATOR console
- Send to analytics platform in key/value pair format

Unidentified Change in Performance



The Situation:

- System performed at “normal” level for period of time
  - CPU utilization
- Over several days, steady increase until “new normal”
- No new applications or virtual servers
- Unknown cause

OMEGAMON

Initial solution

Accept the new normal

Or

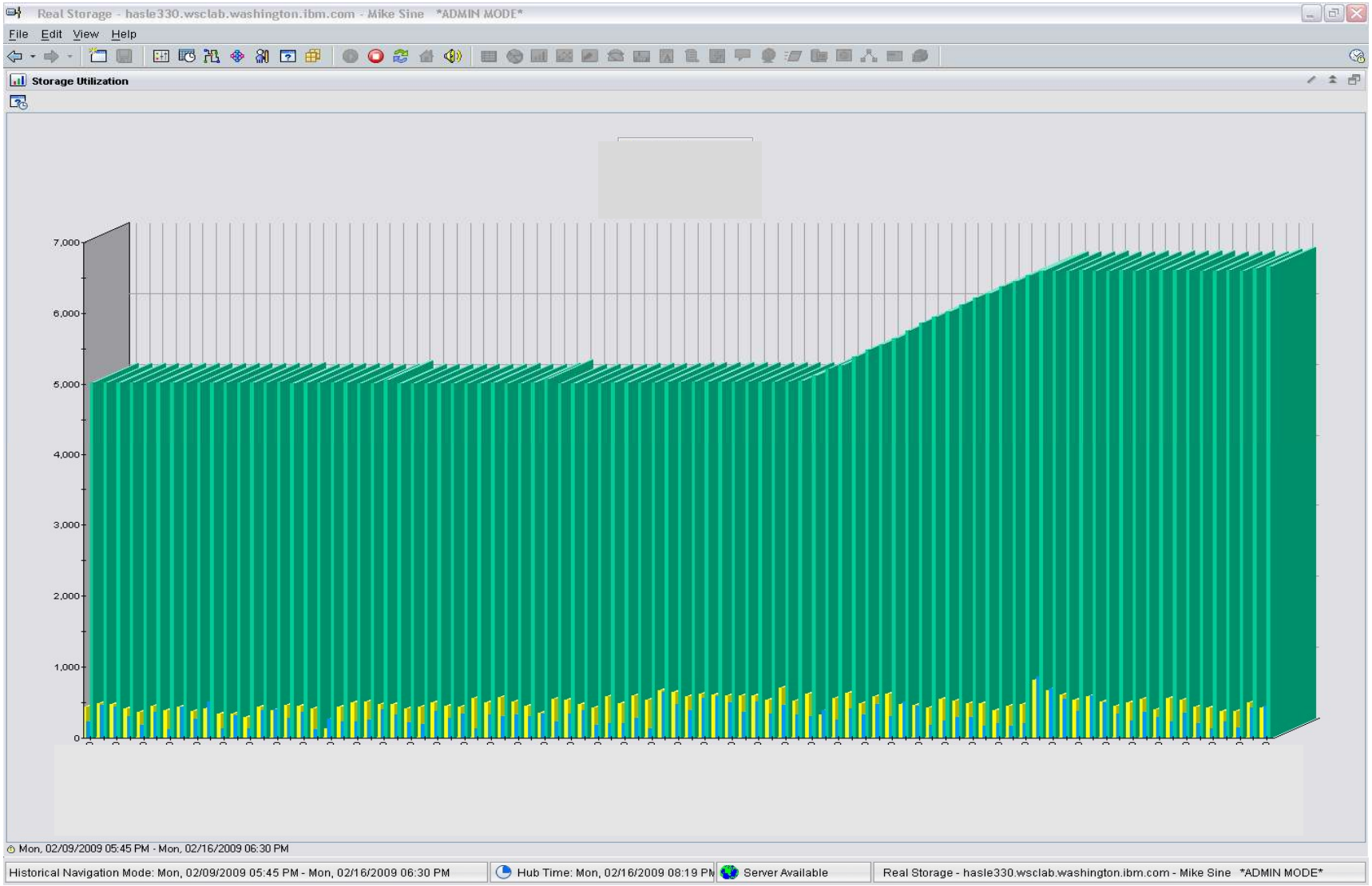
Dig through performance log data (MONITOR records or Performance ToolKit)

Final solution

Change control, historical data collection and access

- Lock in on the period of time of the increase
- Find the specific virtual servers contributing to increase
- Review change control records

On-Demand: Persistent Historical Views



Long Term Recovery of z/VM Files

The Situation:

- Backups of z/VM volumes done from **z/OS**
- Retention is only a few **weeks**
- New release of z/VM installed by less experienced staff
- Some local customizations/automation **not preserved**
- Not available via z/OS backups due to short retention

Backup and Restore Manager

Initial solution

Options

- Keep volume backups on z/OS for months instead of weeks
  - Additional unnecessary data retained longer on tape
  - Tedious file level recovery
- Re-do all customizations from memory (or with help from IBM)

Final solution

File level backup and recovery

- Weekly full backups and daily incrementals of all z/VM log files and customizations
- Retain months or years without large amounts of tape or DASD

System Abend with No Console Data

The Situation:

- **Legacy** best practice of **spooling consoles**
- System abends
- IPL with warm start unsuccessful or not possible
- **No console data** to review what happened leading up to abend
- Dump data only

Operations Manager

Initial solution

IPL cold start and hope for the best

Or

IPL cold start and dig through dump data

Final solution

Console monitoring tool

IPL cold start and review console data written in one log file <u>on disk</u>

Spool and Page Space Full

The Situation:

- **Spool** and **page** space **fill up**
- System abends
- **Unplanned outage**

Operations Manager

Initial solution

Homegrown tool

- Create a service machine running WAKEUP
- Check spool and page space percent full on regular intervals
- Maintain service machine and code for this one function

Final solution

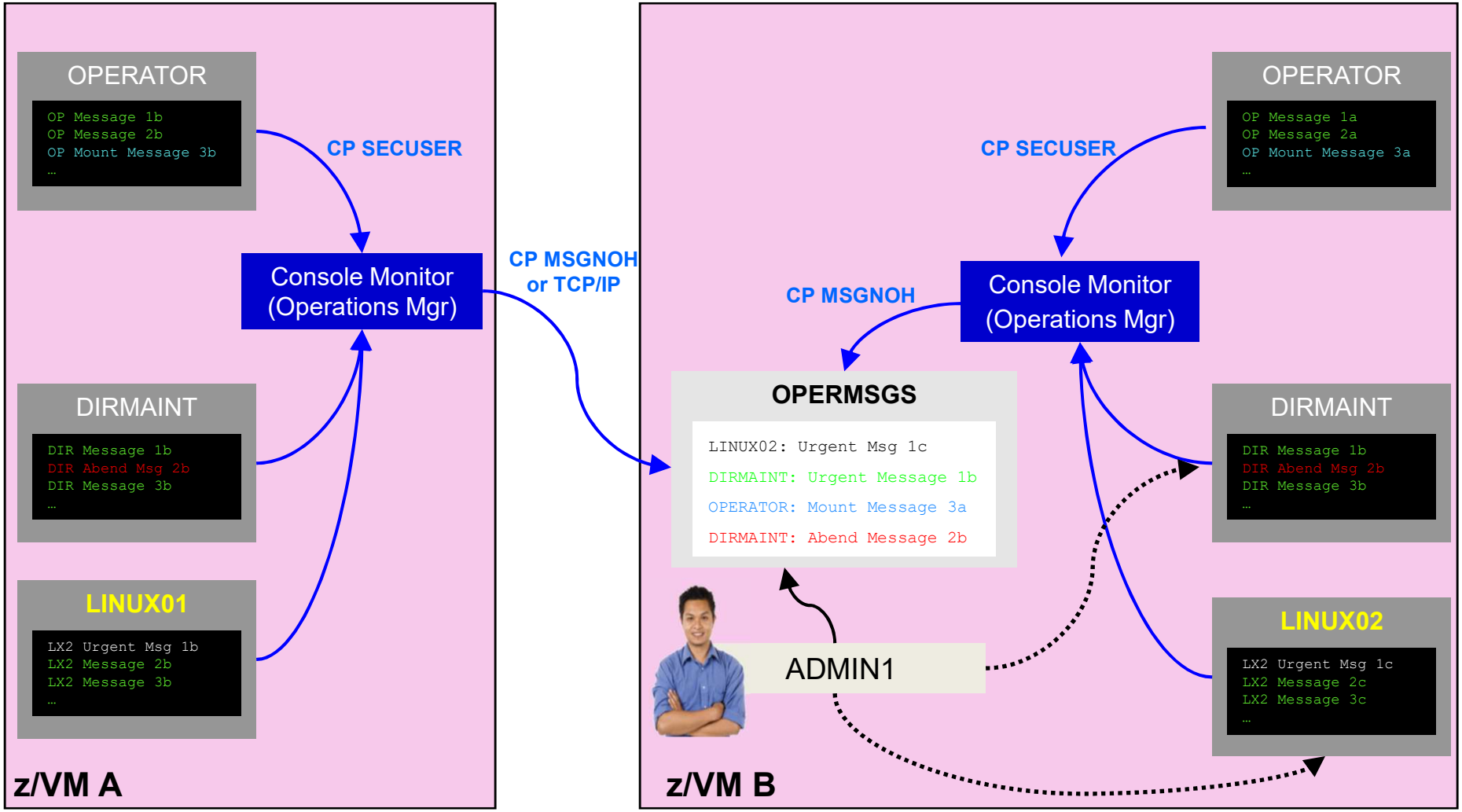
Monitoring tool

- Simple monitor setup
- Watch for percent full to be within threshold range
- Watch for sudden growth
- Take action
- Easily add or change threshold or frequency
- Included in general monitoring/automation

Central Operations Console

- Already have z/OS console in operations center
  - Alerts, important messages
  - Operations staff watching consoles and taking actions
- Want **one** console for all **z/VM** LPARs and **Linux** guests
  - Operations staff sees **only important messages** on central console
  - **When needed** can also look at **full console** of any specific user ID or guest
  - Can expand to include more LPARs as environment grows
    - Still a **single** console

Creating a Central Console Operations Console



Single System Image (SSI) supported but not required

Graceful Shutdown of z/VM from GDPS

The Situation:

- Shutdown of z/VM LPAR included in **GDPS** processing
- **Shutdown** of **Linux** guests handled by **GDPS**
- Need **graceful shutdown** of **z/VM** without triggering monitoring and automation

Operations Manager

Initial solution

None

- **GDPS handled shutdown of guests**
- **Shutdown of z/VM interfered with monitoring and automation**

Final solution

Automated graceful shutdown

- **GDPS signal triggers automation**
- **"Runtime" monitors and automation suspended/deactivated**
- **"Shutdown" monitors and automation resumed/activated**

Perform Weekly System Healthcheck

The Situation:

- Need to monitor system for various thresholds
  - **Spool space** filling up
  - **Paging space** filling up
  - **Disk full** for several z/VM service machines or guest

Operations Manager

Initial solution

Logon weekly and go through checklist manually

Check disk space
Check page space
Check spool space

Final solution

Automate regular monitoring and alerts

Email team if anything approaches threshold

Capturing Linux Log Data

The Situation:

- z/VM console data being captured
- No Linux console data
- Linux log data stored locally on each guest
- Linux server crashes and corrupts file system
- No log data to debug/analyze the problem

Operations Manager

Initial Solution

None

- No log data
- Concerned about too much data being captured on z/VM for Linux guests

Final solution

Capture Linux console & log data

- Console data captured on z/VM and forwarded to Splunk
- Syslog data sent directly to Splunk

Painful Recovery of Critical z/VM Files

The Situation:

- Backups of z/VM volumes done from **z/OS**
- Operational issue (aka user error) **corrupts** a configuration file
- Recovery is **tedious** and error-prone process
  - Restoring whole volume
  - Mapping a new minidisk to the right location on the volume
- Recovery **very** difficult if corrupted file is **USER DIRECT**

Backup Manager

Initial solution

Train people to make backup copies before updating a file

Final solution

File level backup and recovery

Weekly full backups and daily incrementals of all z/VM files

Alert for Excessive CPU by Virtual Server

The Situation:

- Dev/test environment
- 2 IFLs
- Using Performance Toolkit
- Single guest is looping, impacting other guests
- No alerting until someone complained

OMEGAMON Operations Manager

Initial Solution

Set thresholds in Performance Toolkit

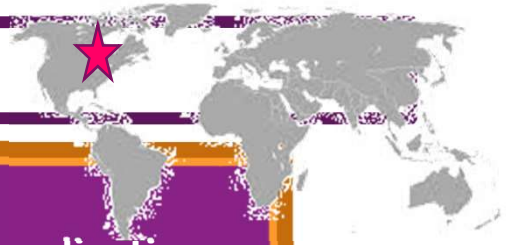
Data about CPU utilization in PerfKit logs
Threshold alert written to PerfKit log
No detailed Linux data

Final solution

Use automation solution to send alerts to central alert system

Long term, still need enterprise performance monitor for z/VM and Linux

Why Was an Application Running Slow



The Situation:

- Application owner asks z/VM system programmer why **application** was running **slow yesterday** afternoon
- Application owner doesn't have the data he needs to research the problem

OMEGAMON

Initial Solution

Look at performance data for z/VM and Linux guest

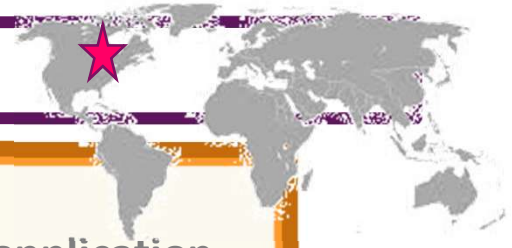
- **Performance data pointed to Linux guest**
- **No application data**

Final solution

One performance monitoring solution for all layers

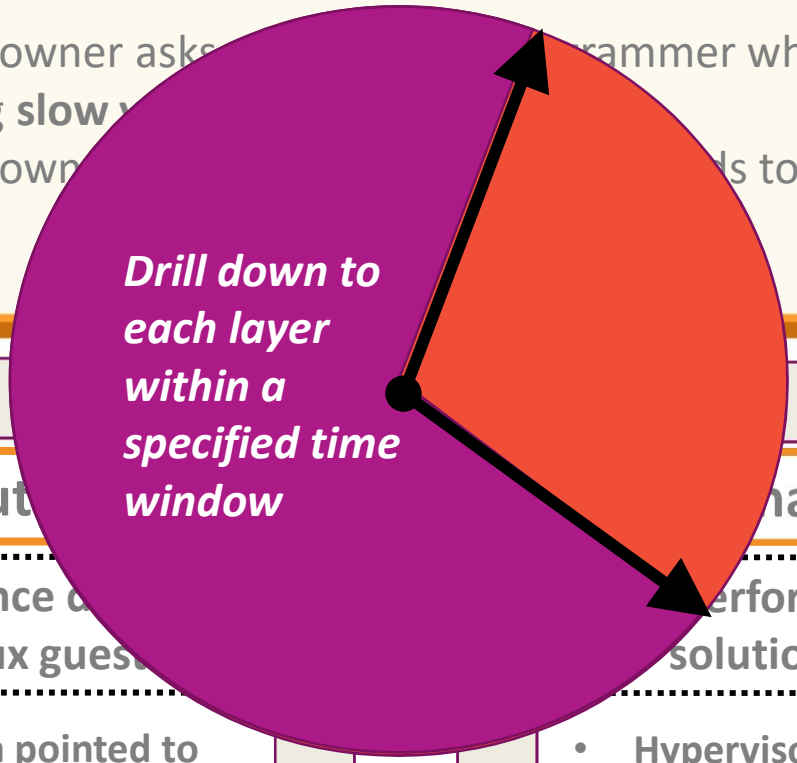
- **Hypervisor**
- **Linux operating system**
- **Application**

Why Was an Application Running Slow



The Situation:

- Application owner asks [illegible]rammer why **application** was running **slow** [illegible]
- Application own[illegible]ds to research the problem



Initial Solut[illegible]

Look at performance d[illegible] z/VM and Linux guest

- Performance data pointed to Linux guest
- No application data

[illegible]nal solution

[illegible]erformance monitoring solution for all layers

- Hypervisor
- Linux operating system
- Application

Hypervisor (CP) Using 25% of CPU

OMEGAMON

The Situation:

- Most monitoring focuses on CPU utilization overall
- Missing focus on **hypervisor's % of CPU** as a separate metric
  - How much is the hypervisor using?
  - What's the "overhead" of the hypervisor
- Best Practice is to investigate if hypervisor using > 10% of CPU
- One morning found hypervisor using 25% of CPU

Initial solution

None

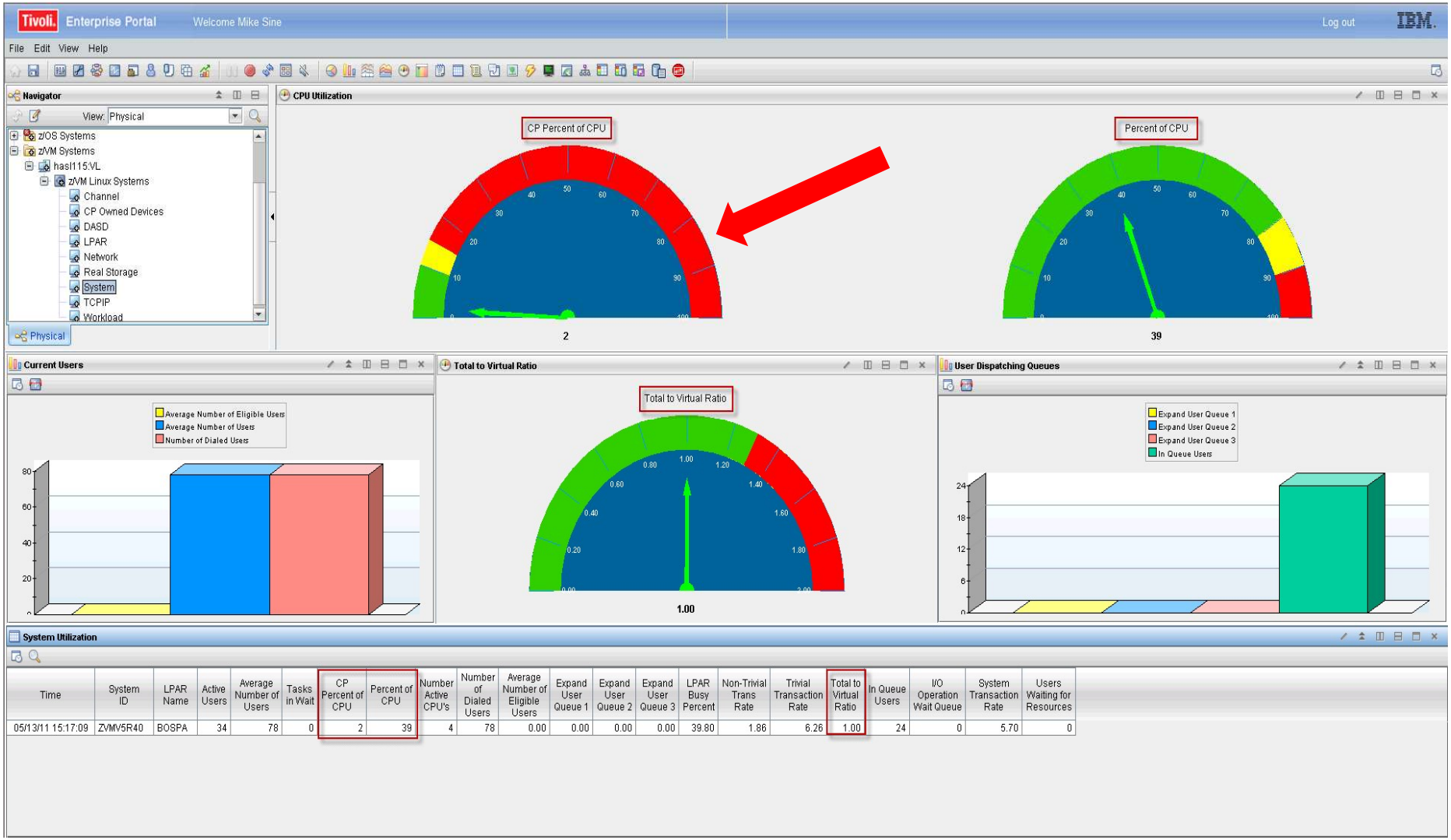
- System CPU measured, while hypervisor (CP) specific numbers omitted
- Reactive steps only taken when performance issue arose

Final solution

Monitoring tool

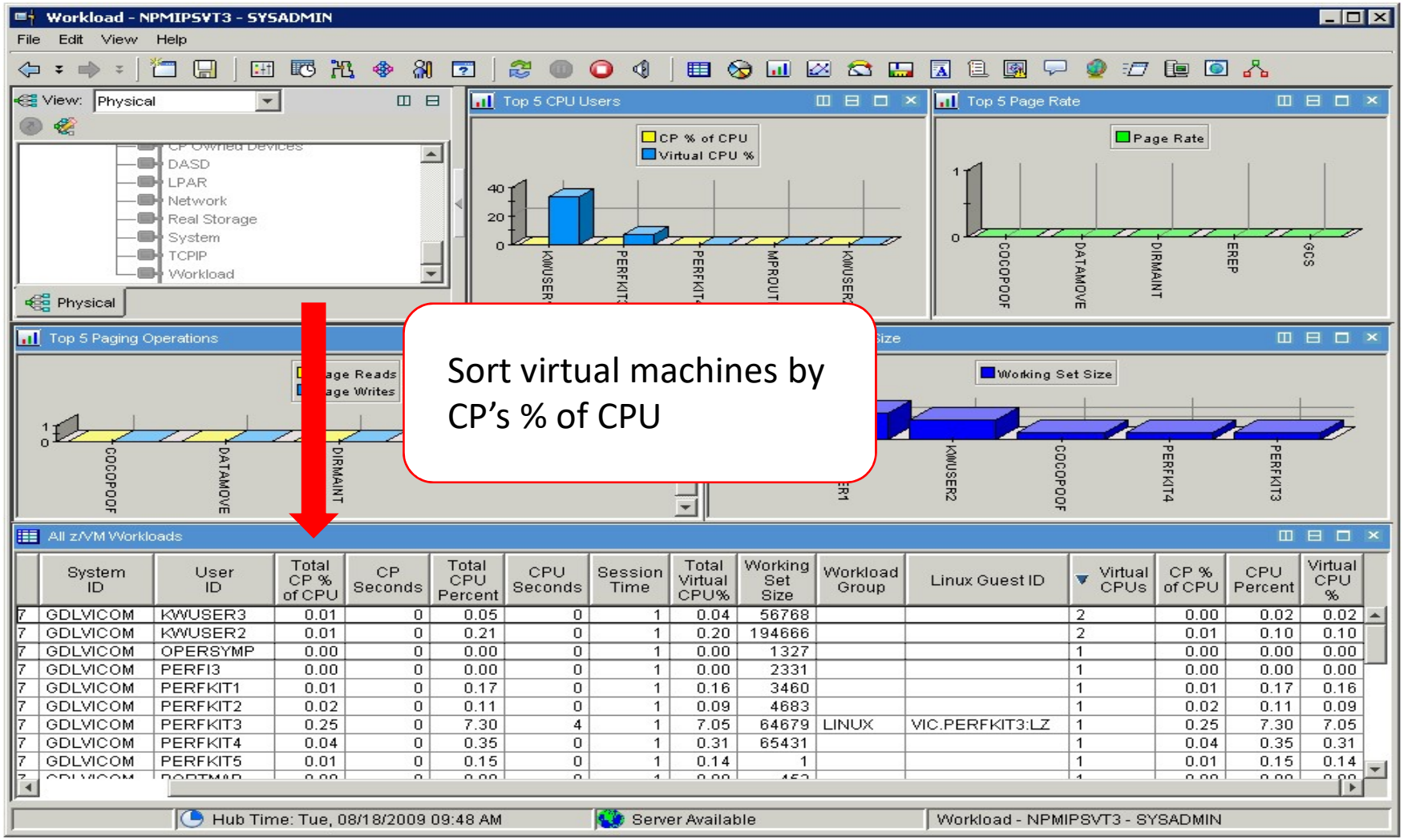
- Automatically monitor CP % for threshold of 10%
- Once threshold is alerted, simple proactive drill down in tool reveals impact often before downstream performance impact is noticed

System Processor Utilization Workspace



Time	System ID	LPAR Name	Active Users	Average Number of Users	Tasks in Wait	CP Percent of CPU	Percent of CPU	Number Active CPU's	Number of Dialed Users	Average Number of Eligible Users	Expand User Queue 1	Expand User Queue 2	Expand User Queue 3	LPAR Busy Percent	Non-Trivial Trans Rate	Trivial Transaction Rate	Total to Virtual Ratio	In Queue Users	I/O Operation Wait Queue	System Transaction Rate	Users Waiting for Resources
05/13/11 15:17:09	ZVMV5R40	BOSPA	34	78	0	2	39	4	78	0.00	0.00	0.00	0.00	39.80	1.86	6.26	1.00	24	0	5.70	0

z/VM Workload Workspace



	System ID	User ID	Total CP % of CPU	CP Seconds	Total CPU Percent	CPU Seconds	Session Time	Total Virtual CPU%	Working Set Size	Workload Group	Linux Guest ID	Virtual CPUs	CP % of CPU	CPU Percent	Virtual CPU %
7	GDLVICOM	KWUSER3	0.01	0	0.05	0	1	0.04	56768			2	0.00	0.02	0.02
7	GDLVICOM	KWUSER2	0.01	0	0.21	0	1	0.20	194666			2	0.01	0.10	0.10
7	GDLVICOM	OPERSYMP	0.00	0	0.00	0	1	0.00	1327			1	0.00	0.00	0.00
7	GDLVICOM	PERFI3	0.00	0	0.00	0	1	0.00	2331			1	0.00	0.00	0.00
7	GDLVICOM	PERFKIT1	0.01	0	0.17	0	1	0.16	3460			1	0.01	0.17	0.16
7	GDLVICOM	PERFKIT2	0.02	0	0.11	0	1	0.09	4683			1	0.02	0.11	0.09
7	GDLVICOM	PERFKIT3	0.25	0	7.30	4	1	7.05	64679	LINUX	VIC.PERFKIT3:LZ	1	0.25	7.30	7.05
7	GDLVICOM	PERFKIT4	0.04	0	0.35	0	1	0.31	65431			1	0.04	0.35	0.31
7	GDLVICOM	PERFKIT5	0.01	0	0.15	0	1	0.14	1			1	0.01	0.15	0.14

Summary and Reference Information

- Production (and dev/test) systems need
  - Monitoring – operational and performance
  - Automation
  - Backup and recovery
- Real situations need to be addressed
  - Learn from others
- Solutions exist
- Demos available
- Contact
  - Tracy Dean, tld1@us.ibm.com

IBM Infrastructure Suite for z/VM and Linux

- Bundle/suite of IBM products
- Tools needed to manage the z/VM and Linux on z Systems infrastructure
- Website:
  - https://www.ibm.com/us-en/marketplace/infrastructure-suite-zvm-and-linux
- DeveloperWorks Wiki – **videos** of product use/demos
  - http://ibm.biz/Bd4up3
- **IBMVM Mailing list**:
  - http://listserv.uark.edu/archives/ibmvm.html

Summary and Reference Information

- IBM Z IT Service Management newsletter
  - Arrives in your inbox once every two months
  - Announcements
  - Coming events
  - Resources
  - Includes: Operational Analytics, Automation, OMEGAMON, IMS Tools, CICS Tools, Storage Tools, z/VM Tools
  - Subscribe: ibm.biz/zITSMNewsletterSubscribe

Available Demos

Automation Demos Available

1. View consoles of Linux guests, Linux syslog data, and CMS user IDs or service machines
2. Send an e-mail based on a console message
3. Send an alert to Netcool/OMNIbus based on a console message, hold and unhold messages
   a. Using POSTZMSG interface to Netcool/OMNIbus
   b. Using SNMP interface to Netcool/OMNIbus
4. Send a message or email if spool approaches full
   a. Send a message if spool usage is too high on any member of an SSI Cluster – see how spool files appear in SSI
   b. Send an email if spool usage is too high on a single system
5. View and clean up spool files
6. Automated spool cleanup
7. Back up or archive DIRMAINT's log files when disk gets full
8. Process a file of test messages as a console
9. Process Linux syslog data as a console
10. Create a central operations console on one z/VM system
11. Create a central operations console across multiple z/VM systems
    a. When the systems are in an SSI cluster
    b. When the systems are not in an SSI cluster
12. Integration with OMEGAMON XE on z/VM and Linux - take action based on CPU usage of Linux guest
13. Monitor service machines for logoff – and autolog them
14. Send an email if page space approaches full
15. Monitor SSI connectivity between 2 cluster members
16. Suppress passwords on Linux consoles
17. Autolog a Linux guest and send message if doesn't start successfully

Backup and Recovery – Demos Available

A. Performing an incremental backup
B. Restoring files from backup
C. Back up and restore single and multiconfiguration users in an SSI environment
D. Scheduling image backups of Linux guests
E. Suspend and resume a guest as part of backup
F. Reviewing a disaster recovery backup
G. Reviewing data in the backup catalog for recovery

धन्यवाद

Hindi

多謝

Traditional Chinese

감사합니다

Korean

Спасибо

Russian

Ndzi khense ngopfu

Tsonga

Gracias

Spanish

Thank You

English

شكراً

Arabic

Obrigado

Brazilian Portuguese

Grazie

Italian

Danke

German

Ke a leboha

Tswana

多谢

Simplified Chinese

Merci

French

நன்றி

Tamil

ありがとうございました

Japanese

ขอบคุณ

Thai