


IBM z Systems

# Customer Experiences:

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

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June 2017



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# 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

The background features a dark blue gradient with several overlapping, semi-transparent geometric shapes. A prominent shape in the lower-left quadrant is a large, multi-faceted polygon with a color gradient from purple to orange. Other smaller, darker shapes are scattered throughout the left side of the frame.

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 TCP/IP initialized
- Customize cloning via REXX scripts

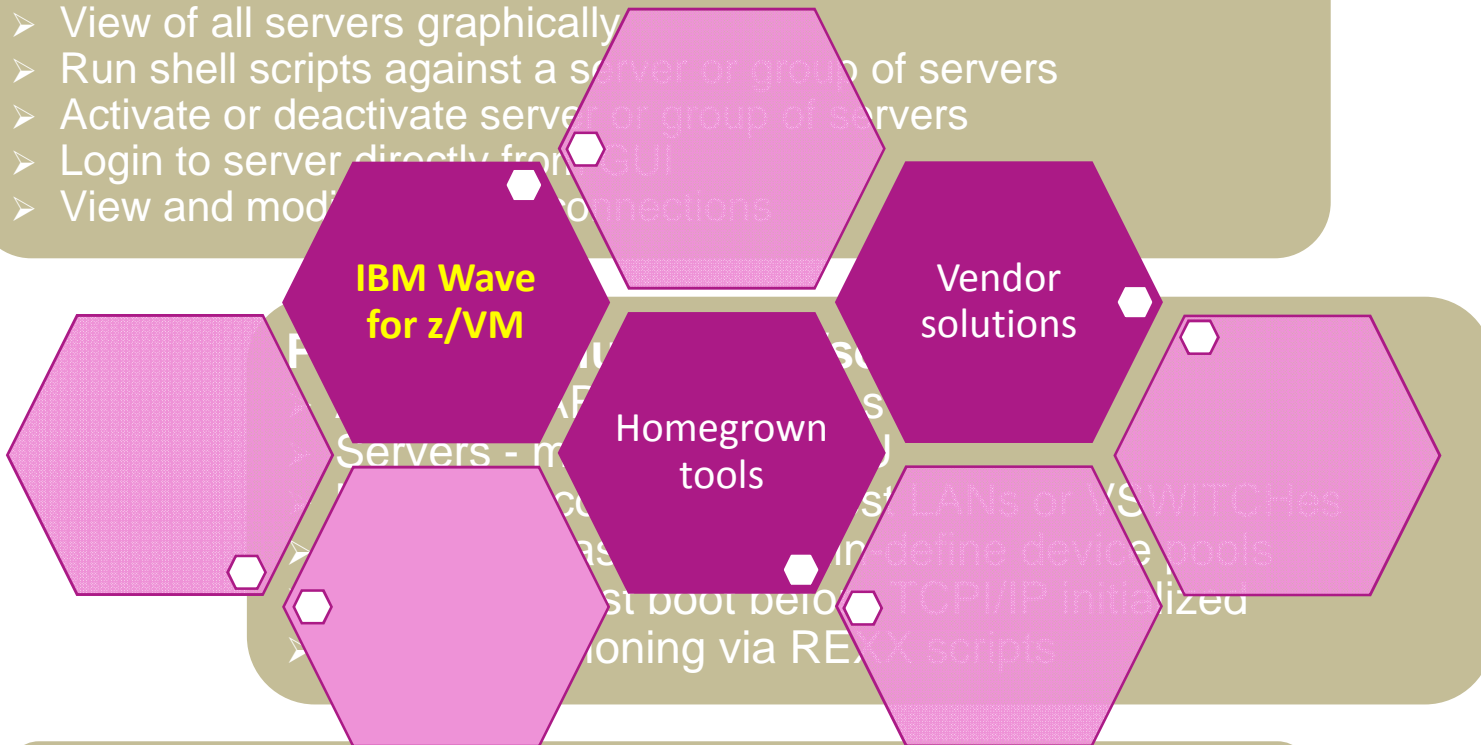
## Real time monitoring

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

# 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





# 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

## 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

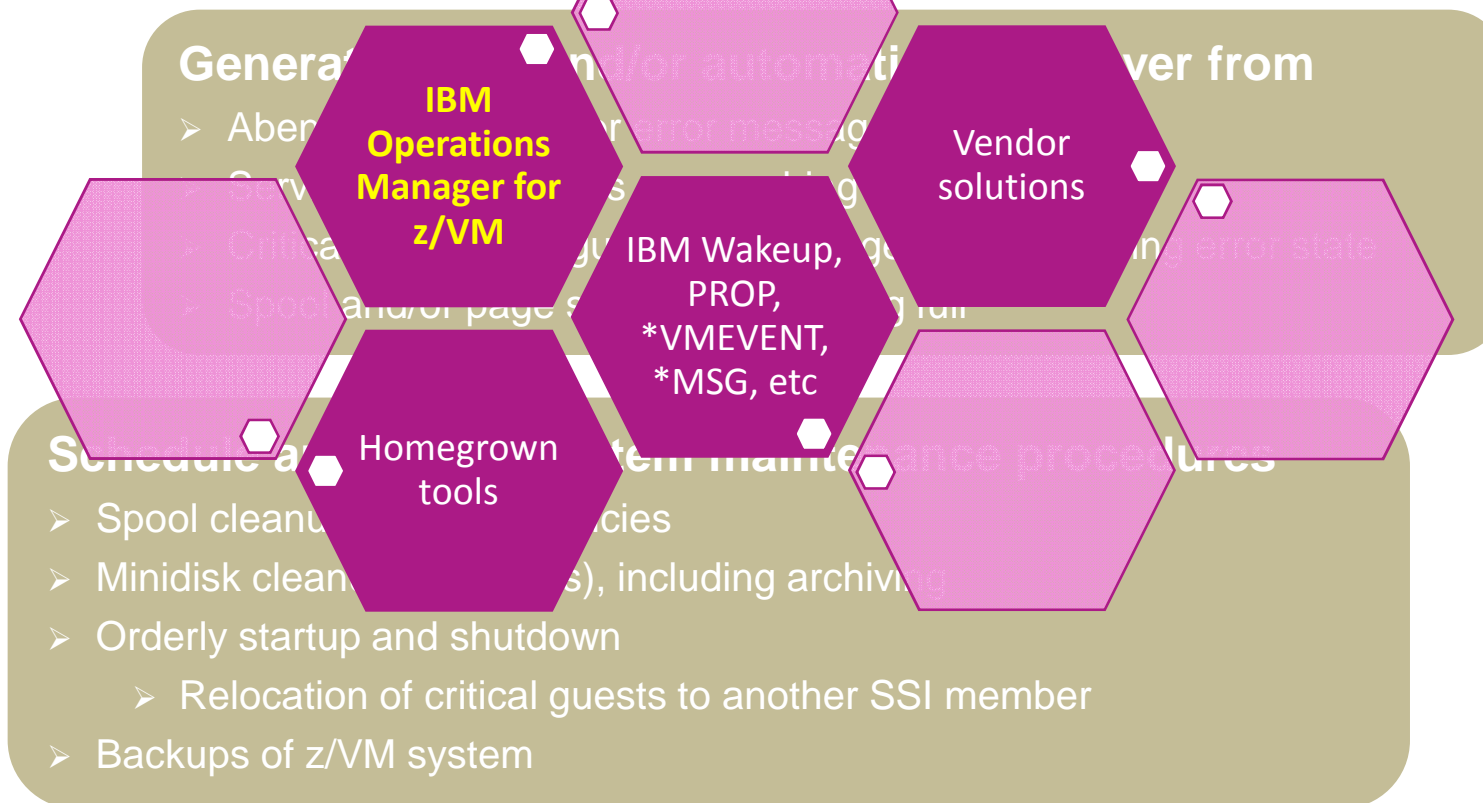
## Schedule automated system maintenance procedures

- 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

# Operational Monitoring and Automation

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

- Operations staff monitoring multiple consoles on a central console of alerts
- System programmers debugging a problem on a guest or service machine



# Backup and Recovery of z/VM and Linux

## Image level backup of z/VM

- Operating system

## File level backup of z/VM data

- Directory information
- Configuration files
- Log files
- Tools – REXX EXECs, automation scripts, etc.

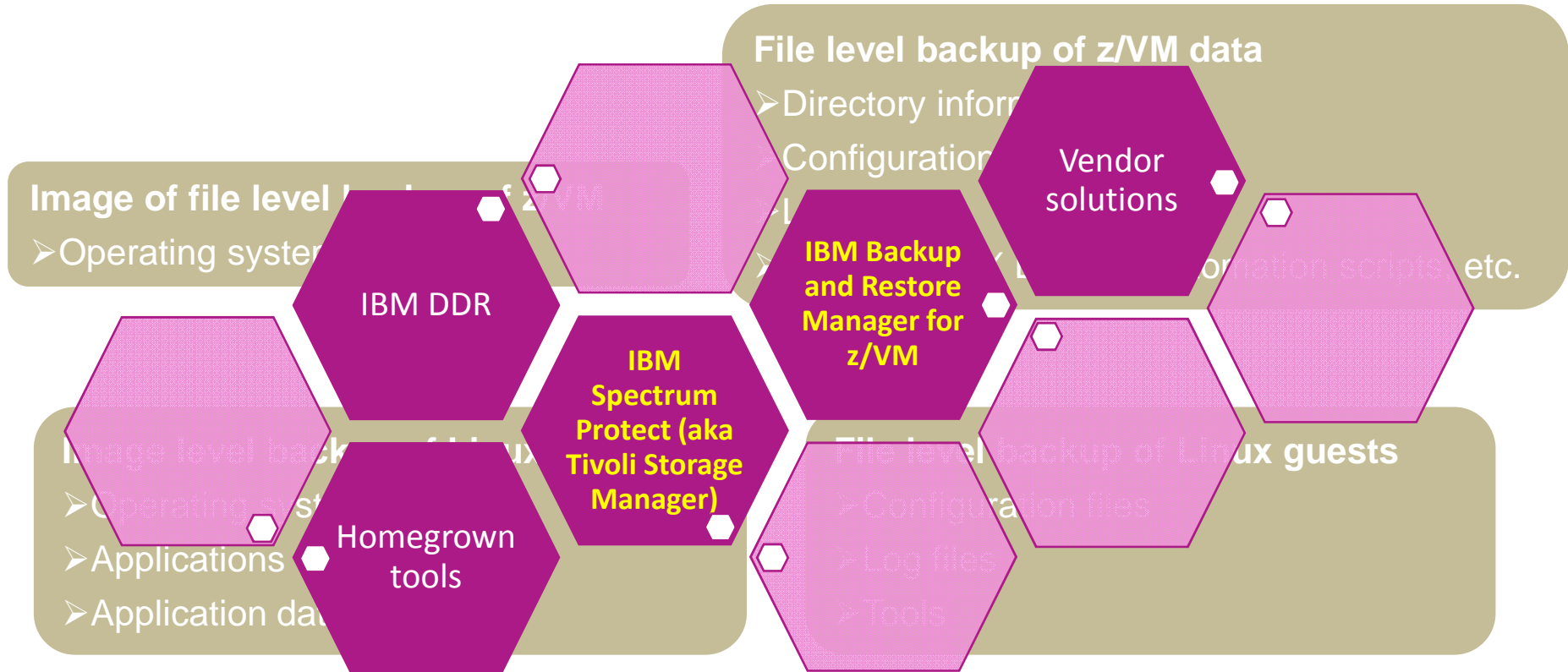
## Image level backup of Linux guests

- Operating system
- Applications
- Application data (maybe)

## File level backup of Linux guests

- Configuration files
- Log files
- Tools

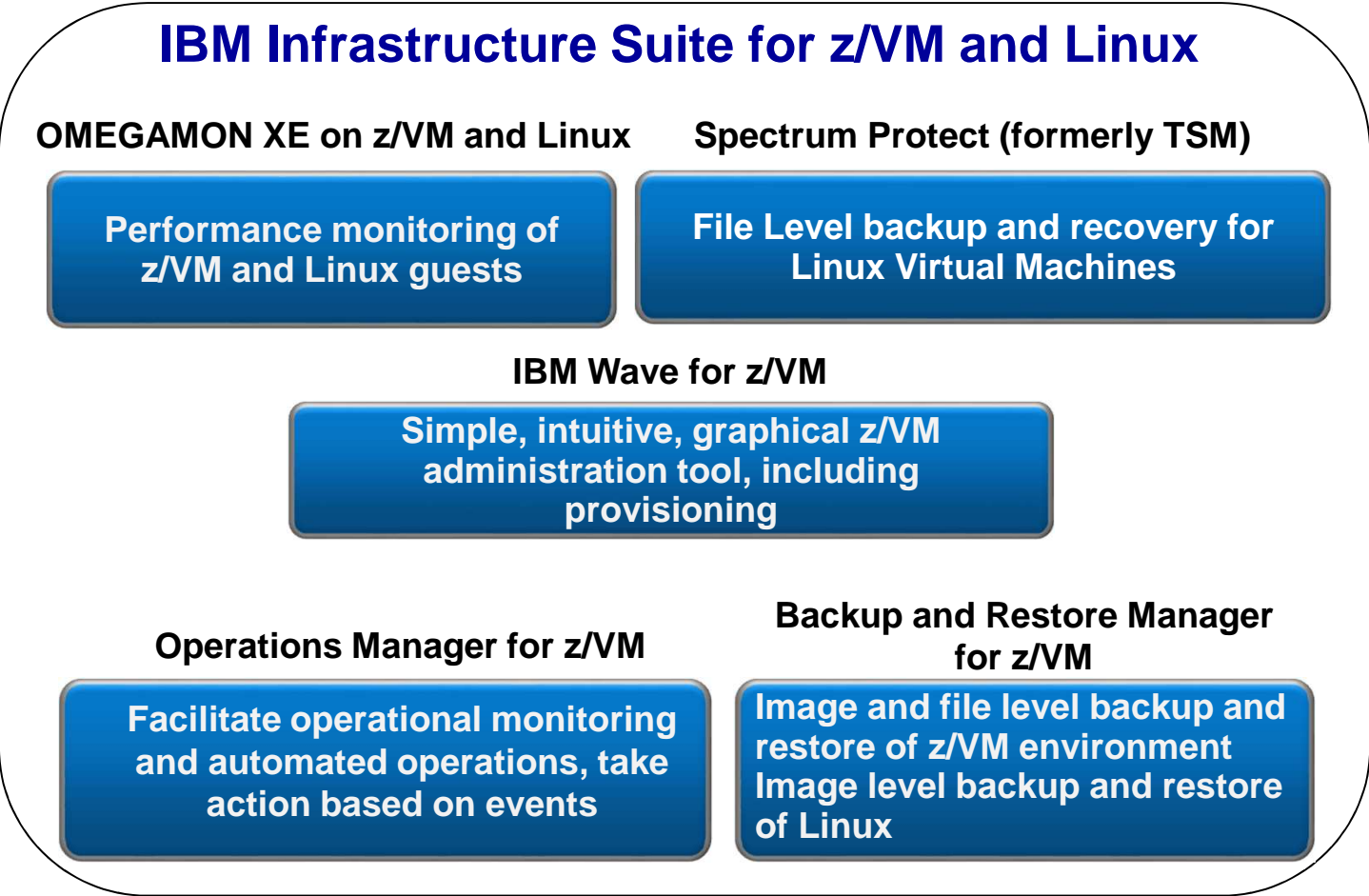
# Backup and Recovery of z/VM and Linux



# 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



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



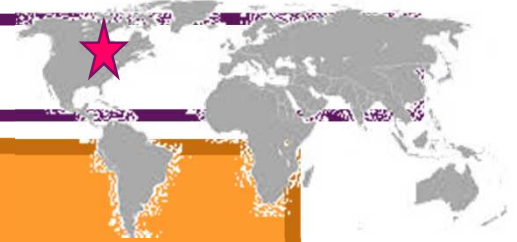
# Customer Scenarios

*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)

Operations  
Manager

### Initial solution

None

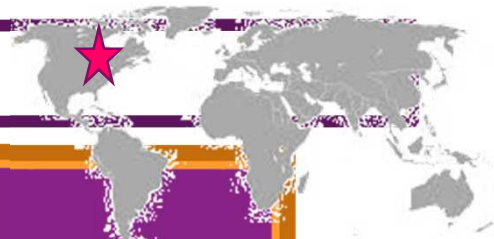
- Took photo of HMC with smartphone
- Show IBM and ask for help
  - **EREP & Accounting disks full**
- No knowledge of impact

### Final solution

Monitoring tool

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

# 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 the Linux guest

- Performance data in logs for the Linux operating system
- 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 z/OS programmer why application was running **slow** yesterday
- Application owner asks z/OS programmer to research the problem

*Drill down to each layer within a specified time window*

### Initial Solution

Look at performance data from the Linux guest

- Performance data in logs for the Linux operating system
- No application data

### Final solution

Performance monitoring solution for all layers

- Hypervisor
- Linux operating system
- Application

# Why Was an Application Running Slow

z/VM

z/VM Linux Systems

- Channel
- CP Owned Devices
- DASD
- LPAR
- Network
- SSI Cluster
- Real Storage
- System
- TCP/IP
- Workload

Physical

Linux Guest Appl Data

Time	System ID	LPAR Name	Virtual CPUs	Total CPU	User ID	U
05/13/15 13:50:08	ZVMV6R30	ROSPA	1	0.30	ESMTS108	
05/13/15 13:32:35	ZVMV6R30	ROSPA	1	0.80	SLESB100	
05/13/15 13:32:34	ZVMV6R30	ROSPA	4	1.40	SLESB103	
					SLESB104	
					SLESB110	
					SLESB113	1

Linux on z Systems

Linux OS

- Capacity Usage Information
- Disk Usage
- File Information
- Network
- Process
- System Information
- Users
- Agent Management Services

Physical

Process Information Detail

Process Command Name	Process ID	Process Parent ID	Cumulative Process User CPU (Percent)	Total Size (Pages)	Resident Set Size (Pages)	8
cupsd	3436	1	0.00	2306	674	435
db2dasrrm	8910	1	0.00	15124	1630	1234
db2fmc	8614	1	0.24	9787	2368	1761

DB2 - db2inst1.has1103:UD

- Customized SQLs
- Application
- Database
- System Overview
- UDB\_Status\_Warning
- Locking Conflict
- Buffer Pool Activity
- Table Space

- Notice an anomaly at the z/VM workload level
- Link to the Linux Process view
- Link to one or more DB2 views

DB2 UDB Agent

DB2 Status	Node Name	DB2 S
Inactive/Busy	db2inst1.has1103:UD	

# Coordinate Application Shutdown with z/OS

## The Situation:

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

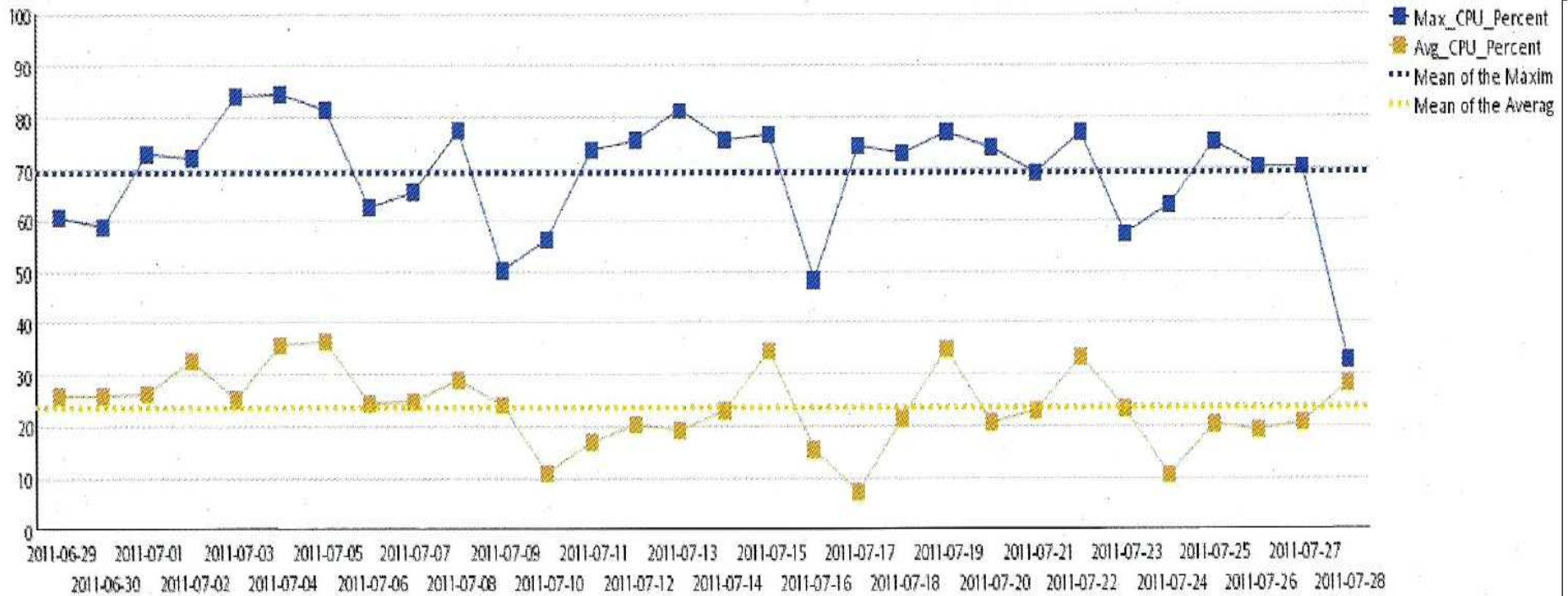
### Final solution

#### Monitoring tool

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



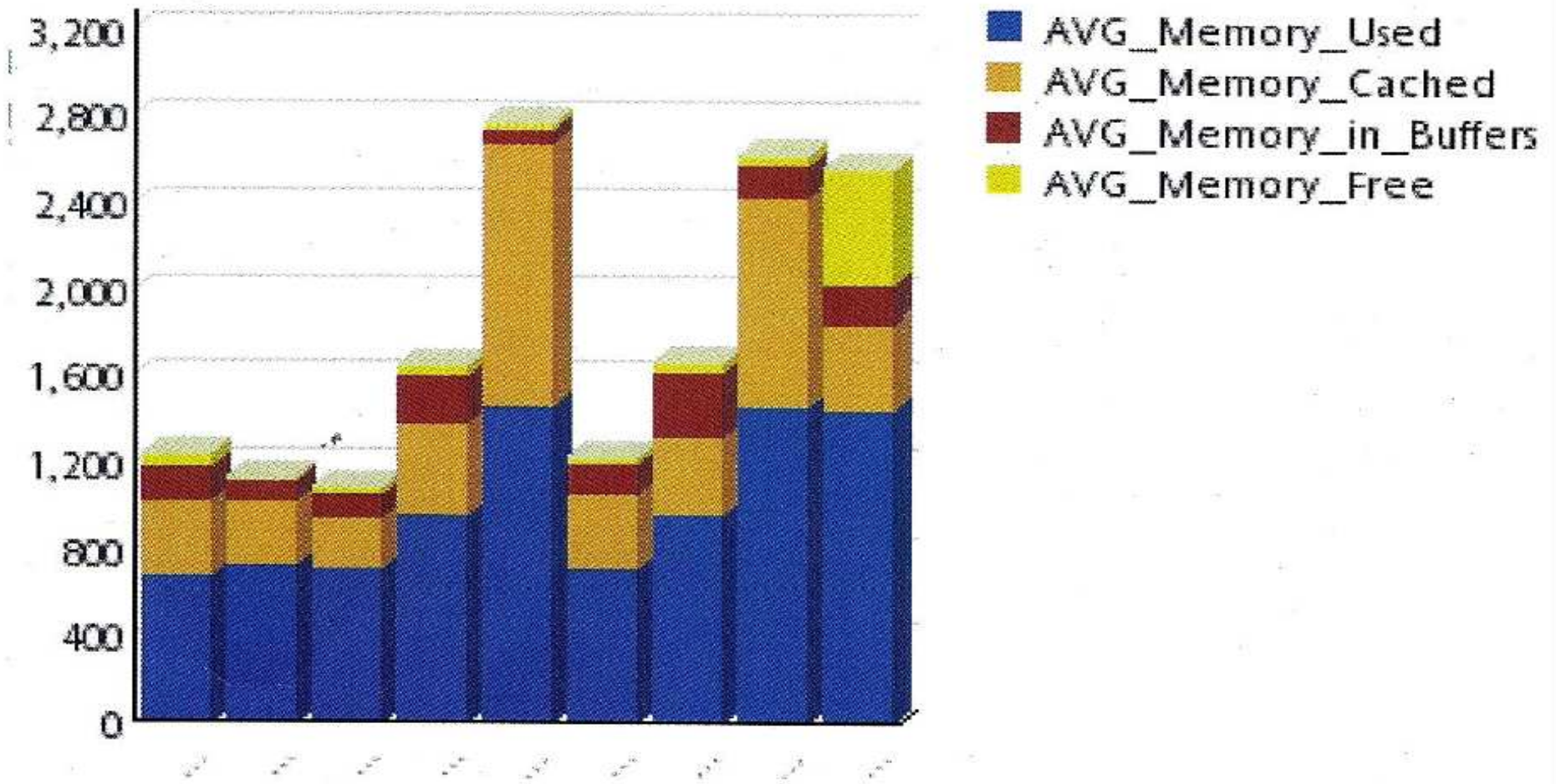
# Maximum and Average CPU example



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





# 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

Operations Manager

### Initial solution

#### Manual processing

- Common configuration information maintained on one system
- Shared within SSI cluster
- Manually sent 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

# Hypervisor Using 25% of CPU



**The Situation:**

- Most monitoring focuses on CPU utilization overall
- Missing focus on **CP's % of CPU** as a separate metric
  - How much is the hypervisor using?
- Best Practice is to investigate if hypervisor using > 10% of CPU
- One morning found CP% at 25%, simple drill down revealed cause

**Initial solution**

**None**

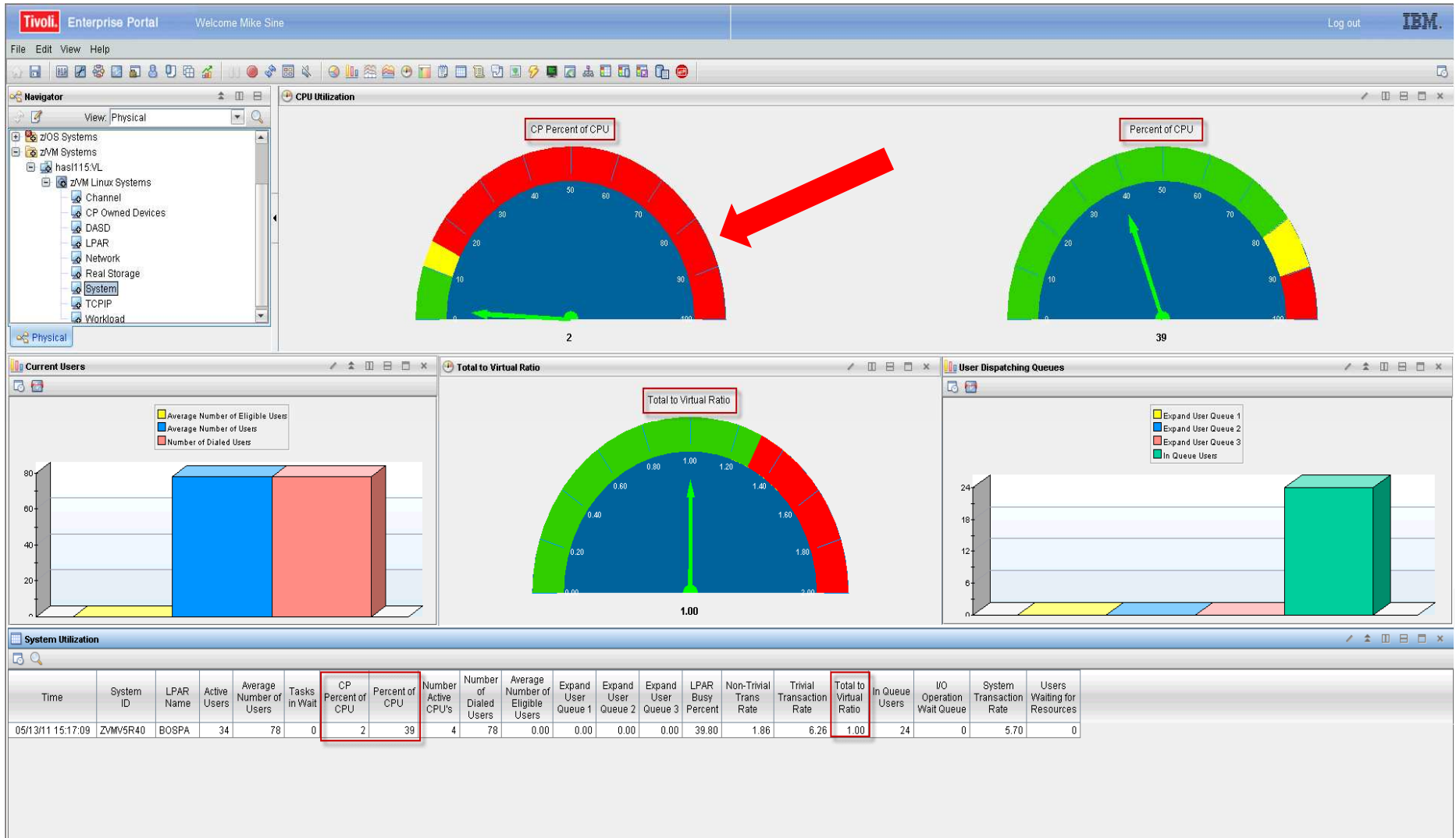
- System CPU measured, while hypervisor (CP) specific numbers omitted
- Reactive steps only taken when performance issue arose

**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



# z/VM Workload Workspace

The screenshot displays the z/VM Workload Workspace interface. It includes several monitoring panels:

- Top 5 CPU Users:** A bar chart showing CPU usage for users like KWUSER, PERFKIT, and MPROUT.
- Top 5 Page Rate:** A bar chart showing page rates for users like 0000P00F, DATAMOVE, and DIRMAINT.
- Top 5 Paging Operations:** A bar chart showing page reads and writes for users like 0000P00F, DATAMOVE, and DIRMAINT.
- Working Set Size:** A bar chart showing working set sizes for users like KWUSER2, 0000P00F, PERFKIT4, and PERFKIT3.
- All z/VM Workloads:** A table listing various workloads with columns for 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, and Virtual CPU %.

A red arrow points from a callout box to the 'Total CP % of CPU' column in the table. The callout box contains the text: "Sort virtual machines by CP's % of CPU".

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	
7	GDLVICOM	BOBTMAP	0.00	0	0.00	0	1	0.00	452		1	0.00	0.00	0.00	

# 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
- 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

# 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

### 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 on disk

# 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

### 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

## 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
- Shutdown monitors and automation resumed



# 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



## 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

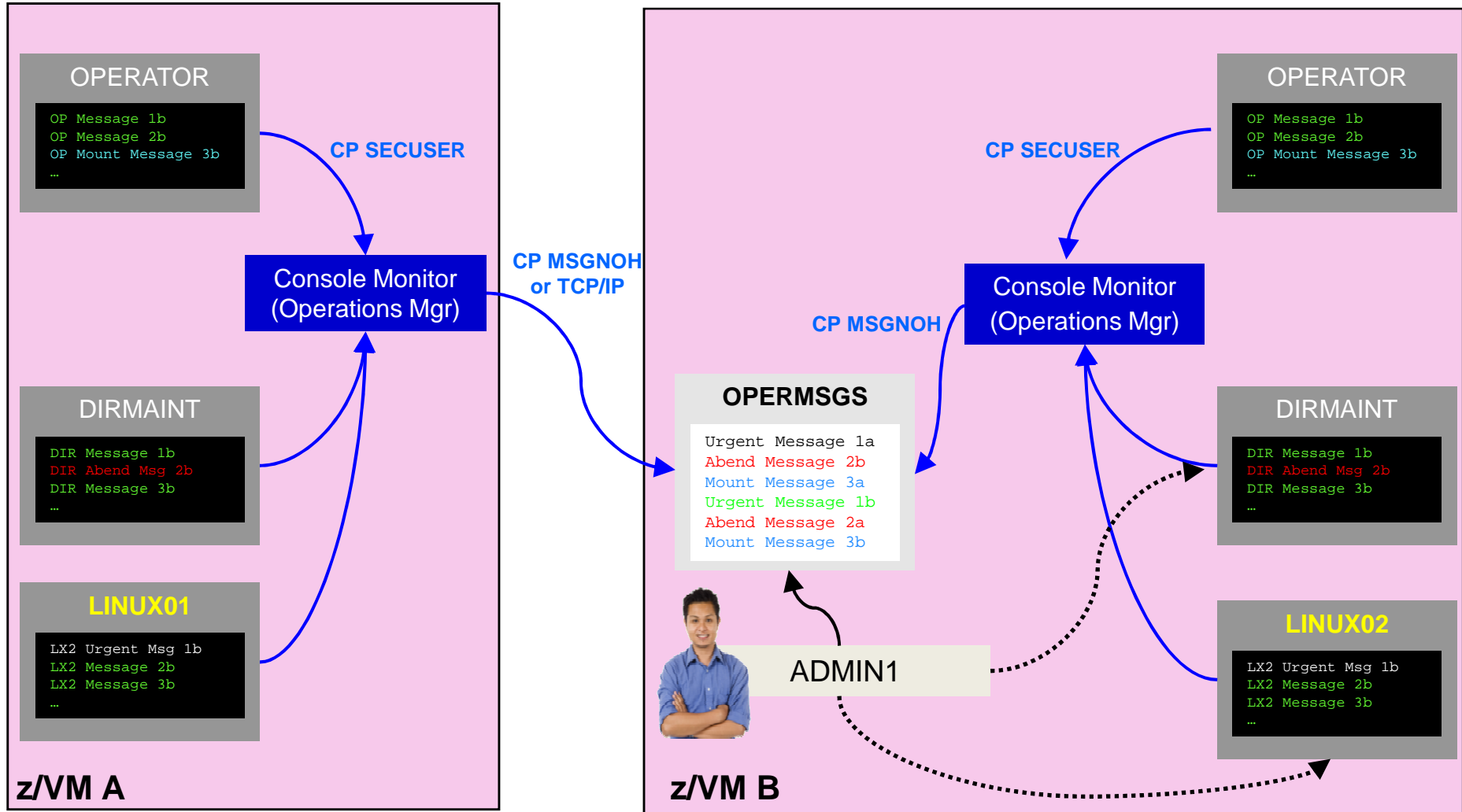
## Central Operations Console



- Already have z/OS console in operations center
  - Alerts, important messages, etc. for operations staff
- 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



# Perform Weekly System Healthcheck



## The Situation:

- Need to monitor system to verify not approaching a threshold
  - **Spool space** filling up
  - **Paging space** filling up
  - **Disk full** for several z/VM service machines or guests

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

# Perform Weekly System Healthcheck

## The Situation:

- Need to monitor system to verify not approaching a threshold
  - **Disk full** for several z/VM service machines or guests

- Add additional automation to automatically clean up the disk
  - Back up or archive data
  - Erase files

### Initial solution

Logon weekly and go through checklist manually

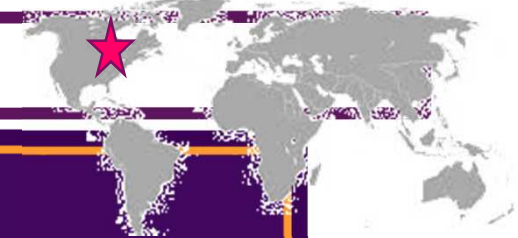
Check disk space  
Check page space  
Check spool space

### Final solution

Automate regular monitoring and alerts

Email team if anything approaches threshold

# 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



**Initial solution**

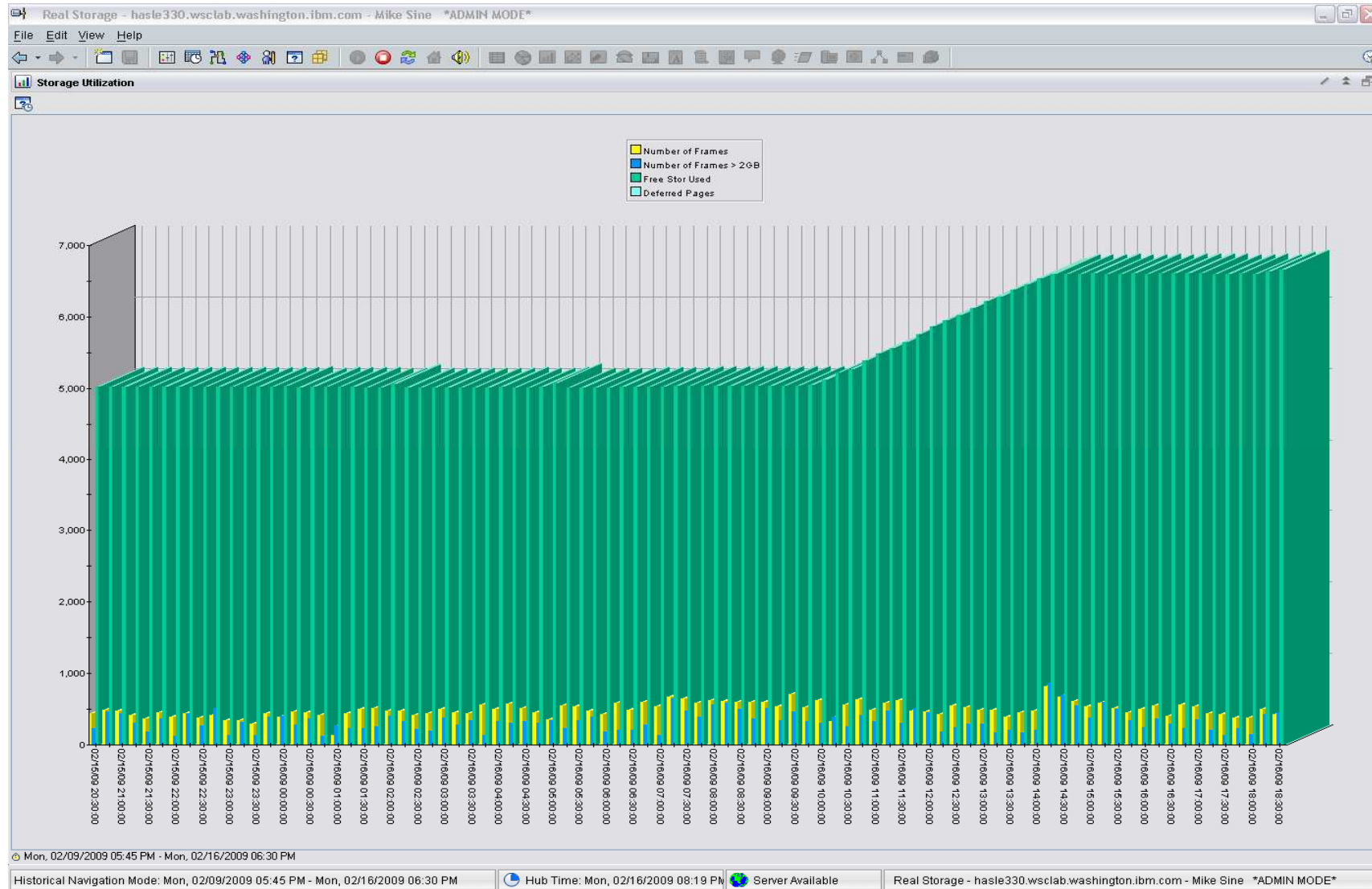
Accept the new normal  
**Or**  
Dig through performance log data  
(MONITOR records or  
Performance Toolkit)

**Final solution**

Change control, historical data  
collection and access

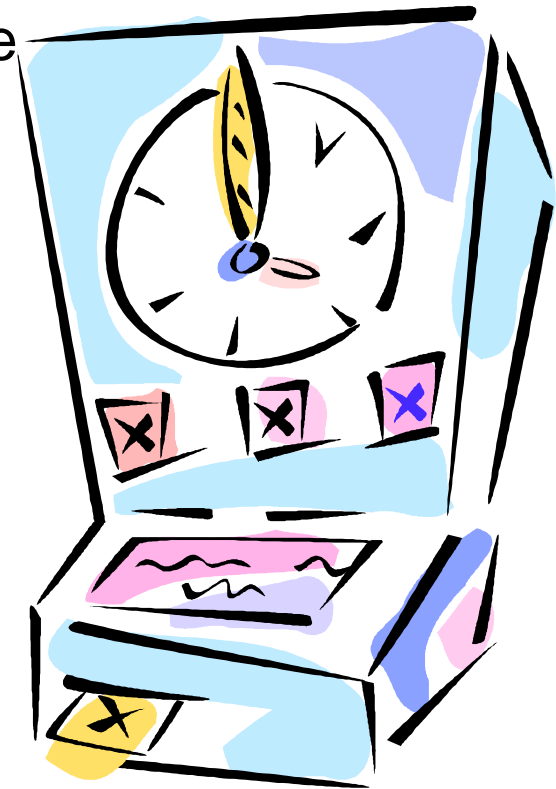
Lock in on the period of time of the  
increase  
Find the specific virtual servers  
contributing to increase  
Review change control records

# On-Demand: Persistent Historical Views



## History On-Demand with Persistent Historical Views

- Easier to see anomalies, or match spikes
- Capturing performance data as a base line is a must:
  - General history data – business as usual
  - Detailed raw monitor data prior to and following any major changes
  - Ability to review attributes of a past incident through the enterprise view!
  - On-Demand through the Portal or Batch






# 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 only
- Mainframe operations team not able to participate

### 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

# 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**



## 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

## 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](mailto:tld1@us.ibm.com)
  - Mike Sine, [sine@us.ibm.com](mailto:sine@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
  - Wave for z/VM
  - OMEGAMON XE on z/VM and Linux
  - Operations Manager for z/VM
  - Backup and Restore Manager for z/VM
    - Order Tape Manager for z/VM separately if plan to back up to tape
  - Spectrum Protect Extended Edition (formerly Tivoli Storage Manager)
- Discounted price as a bundle
- Website:
  - <http://www.ibm.com/software/products/en/ibm-infrastructure-suite-for-zvm-and-linux>
- DeveloperWorks Wiki – **videos** of product use/demos
  - <http://ibm.biz/Bd4up3>
- **IBMVM Mailing list:**
  - <http://listserv.uark.edu/archives/ibmvm.html>

The background features a complex geometric pattern of overlapping triangles and polygons. The color palette is primarily dark blue and purple, with a prominent orange and red triangle in the lower-left quadrant. The overall effect is a modern, abstract design.

Live 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

شكراً

Arabic

Thank

English

You

Obrigado

Brazilian Portuguese

Grazie

Italian

多谢

Simplified Chinese

Danke

German

Ke a leboha

Tswana

Merci

French

நன்றி

Tamil

ありがとうございました

Japanese

ขอบคุณ

Thai