IBM **z Systems**

Customer Experiences:

Managing the z/VM and Linux on z Systems Infrastructure

Tracy Dean
IBM
tld1@us.ibm.com

June 2015

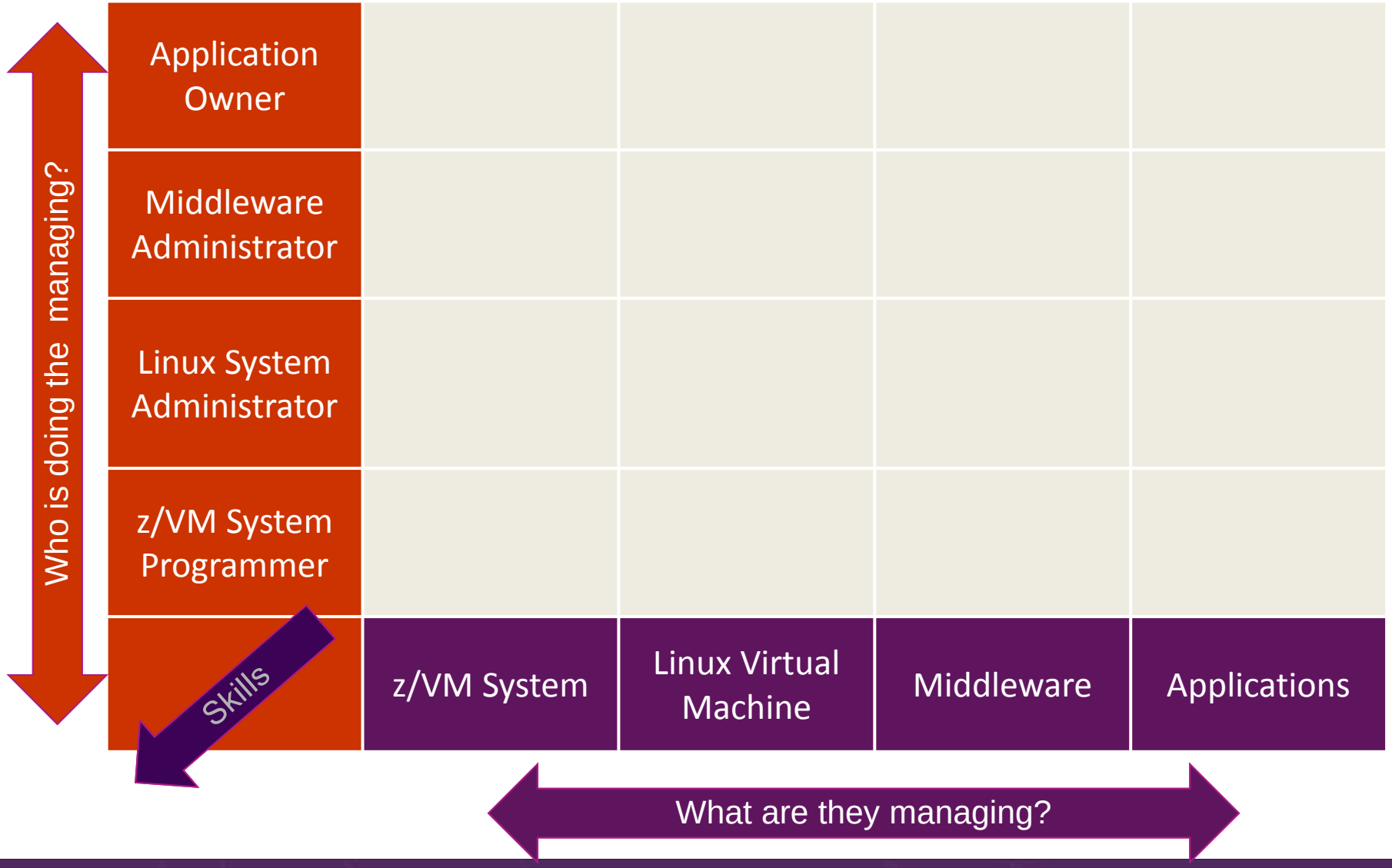
IBM

Agenda

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

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

Three Dimensions of Systems Management



Three Dimensions of Systems Management

Who is doing the managing?

Skills	z/VM System	Linux Virtual Machine	Middleware	Applications
Application Owner				
Middleware Administrator	✓	✓	✓	
Linux System Administrator	✓	✓	✓	
z/VM System Programmer	✓	✓	✓	

What are they managing?

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

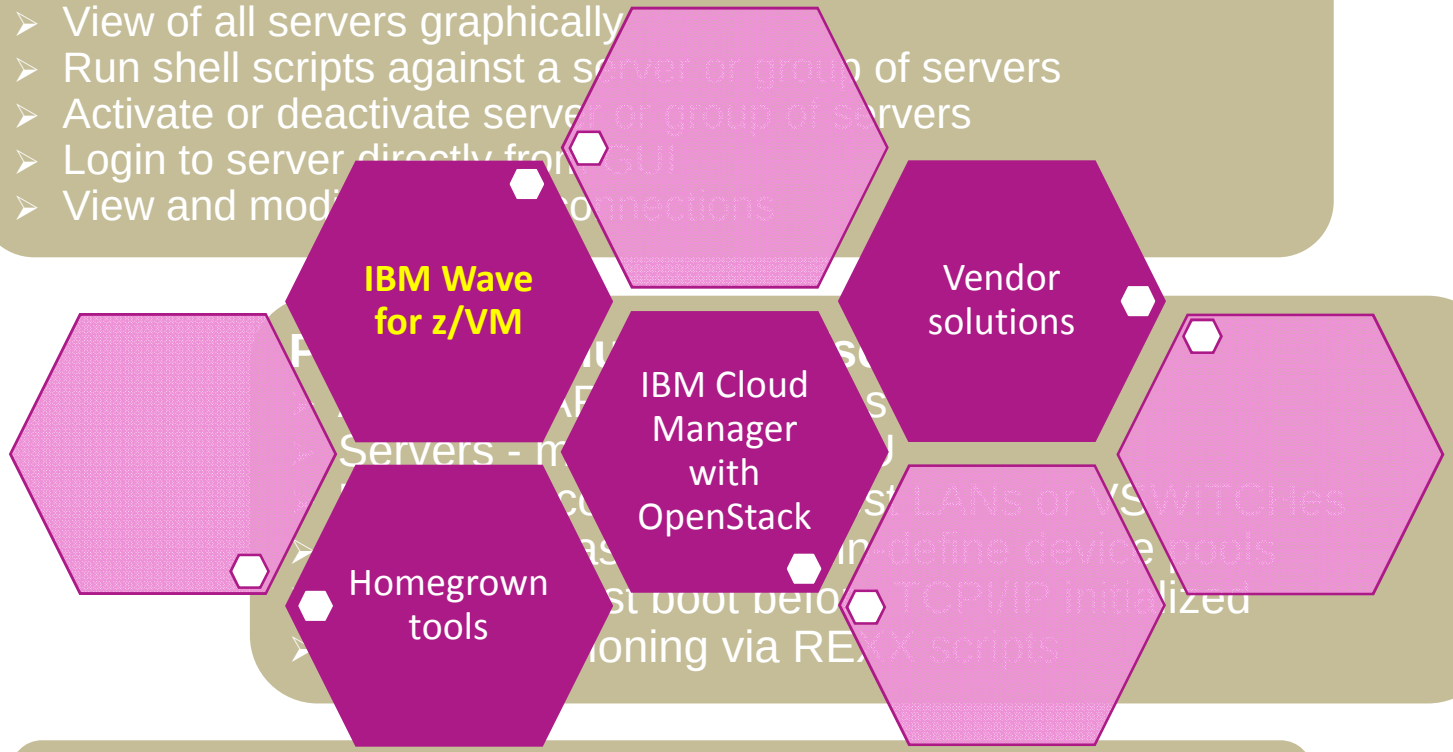
Provision Linux guests/servers
- Across LPARs or machines
- Memory and CPU
- Network – connect to Guest LANs or VSWITCHes
- Storage – based on admin-defined device pools
- Customize first boot before TCPI/IP initialized
- Customize cloning via REXX scripts

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

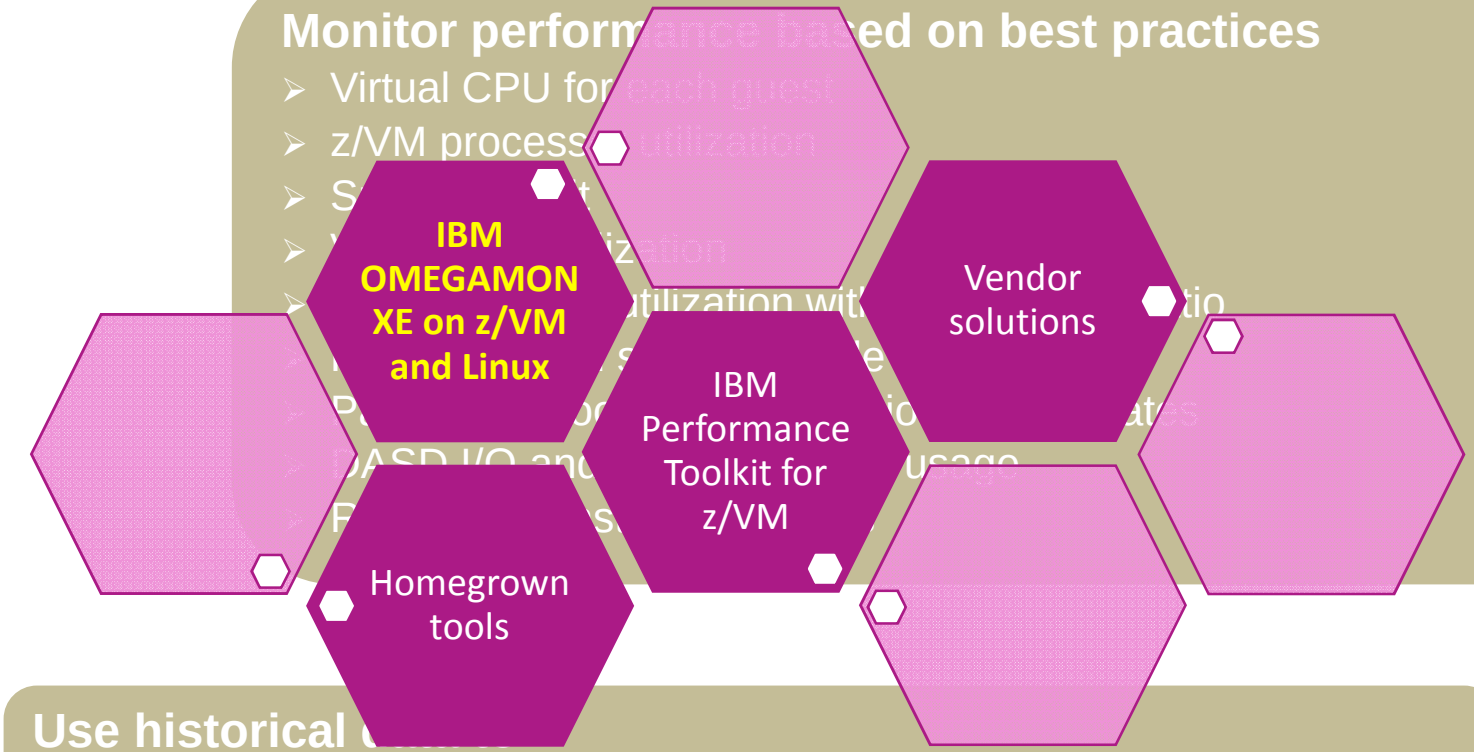
Use historical data to

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

Performance Monitoring and Automation

Monitor performance based on best practices

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



Use historical data

- 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

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 or a central console of alerts

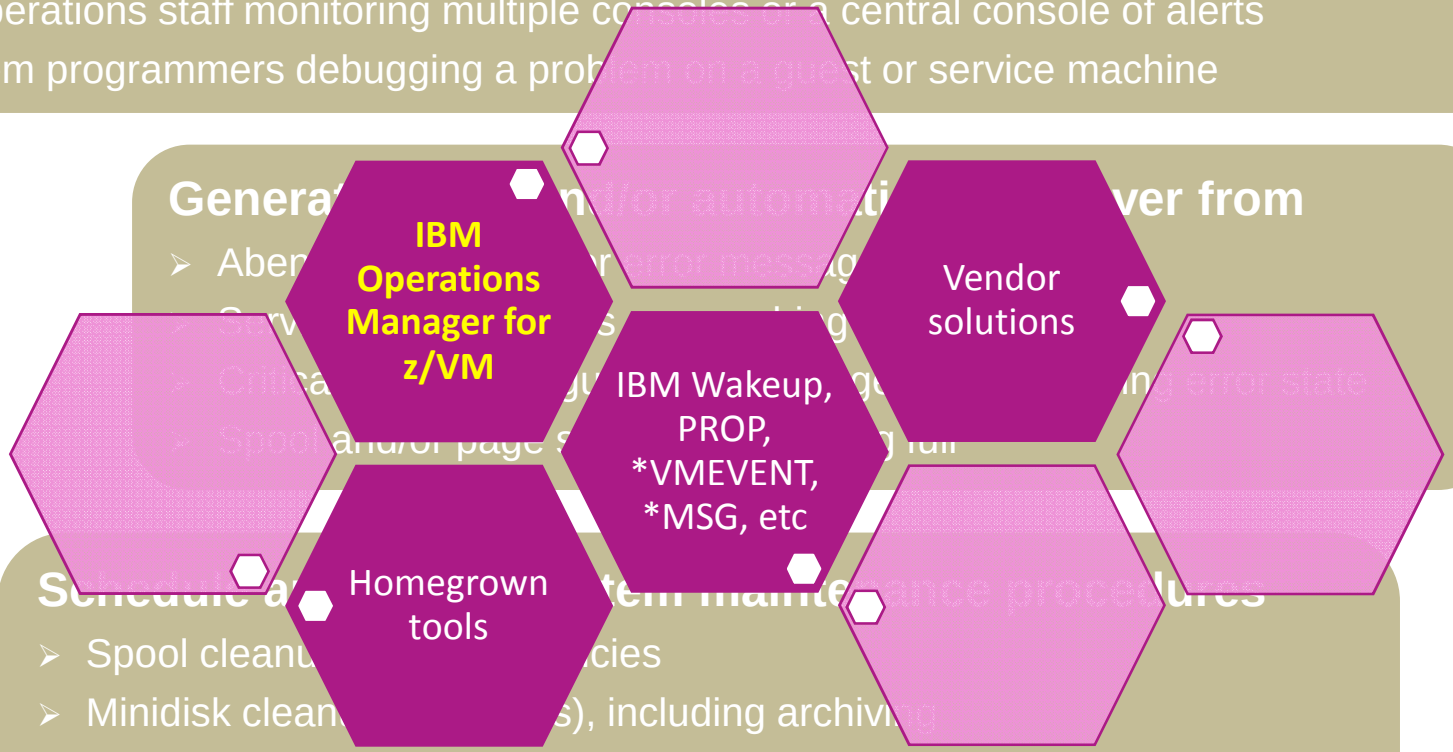
System programmers debugging a problem on a guest or service machine

Generate messages and/or automatically recover from

- Abend messages or error messages
- Servers stopping or hanging
- Critical guest or service machine entering error state
- Spool and/or page space filling full

Schedule and automate system maintenance procedures

- Spool cleanup policies
- Minidisk cleanup (purges), 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

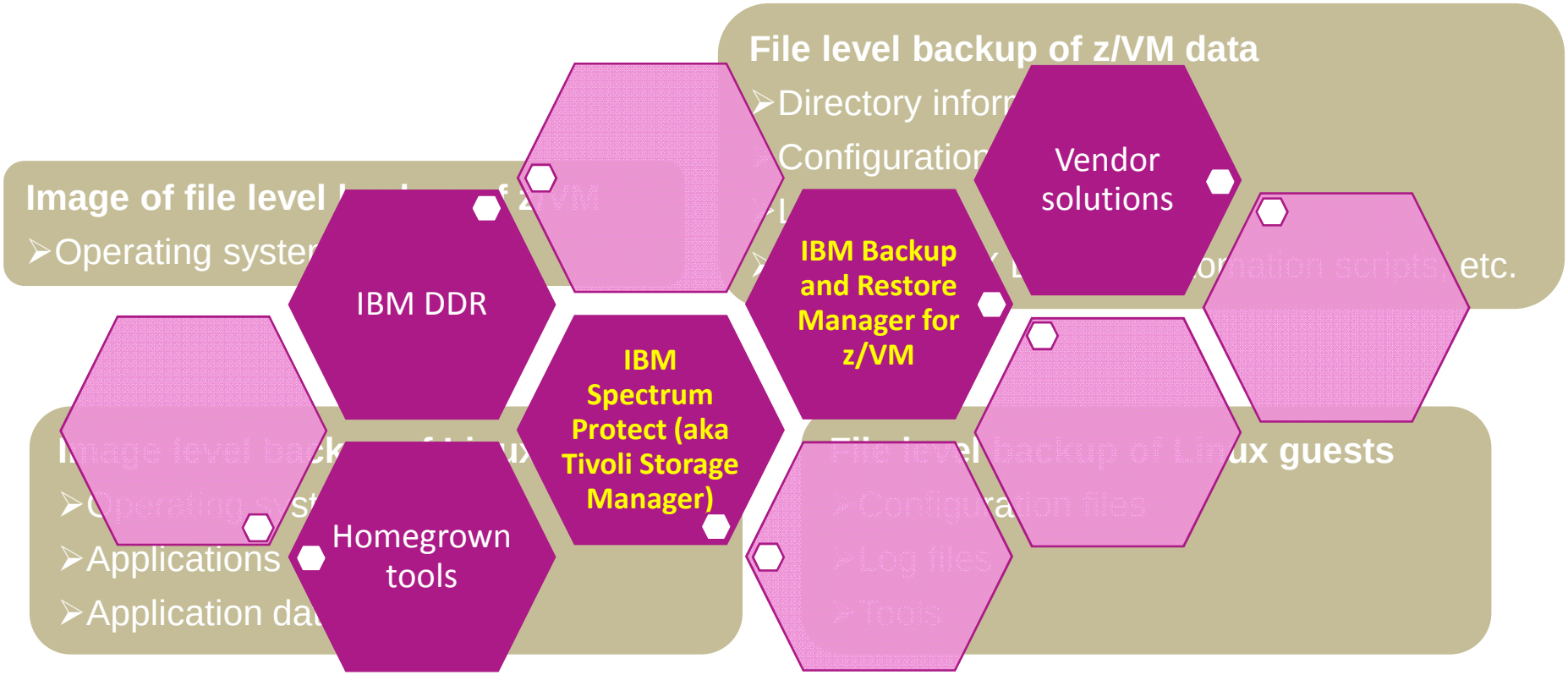
File level backup of z/VM data
- Directory information
- Configuration files
- Log files
- Tools – REXX EXECs, automation scripts, etc.

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



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

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
- **EREP** disk **full**
- **Accounting** disk **full**

Initial solution

None

- Took photo of HMC with smartphone
- Show IBM and ask for help
- No knowledge of impact of the message

Final solution

Monitoring tool

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

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

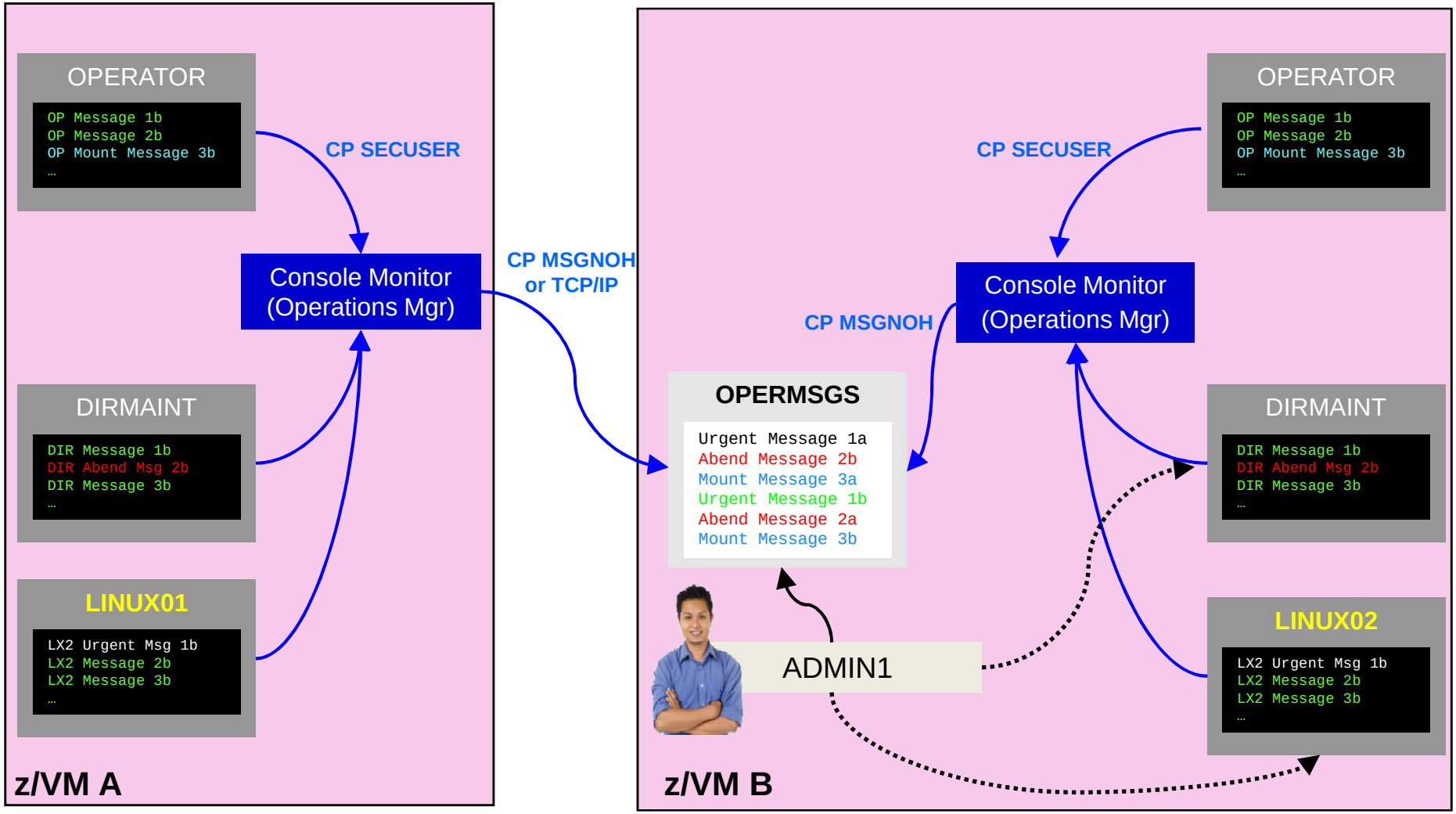
Console monitoring tool

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

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



Spool and Page Space Full

The Situation:

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

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

Resource Constraint Analysis

The Situation:

- Performance monitor says **CPU utilization** for system is **high**
- Is that a **problem?**
- What's the **impact** on the **applications?**

Initial solution

Guess

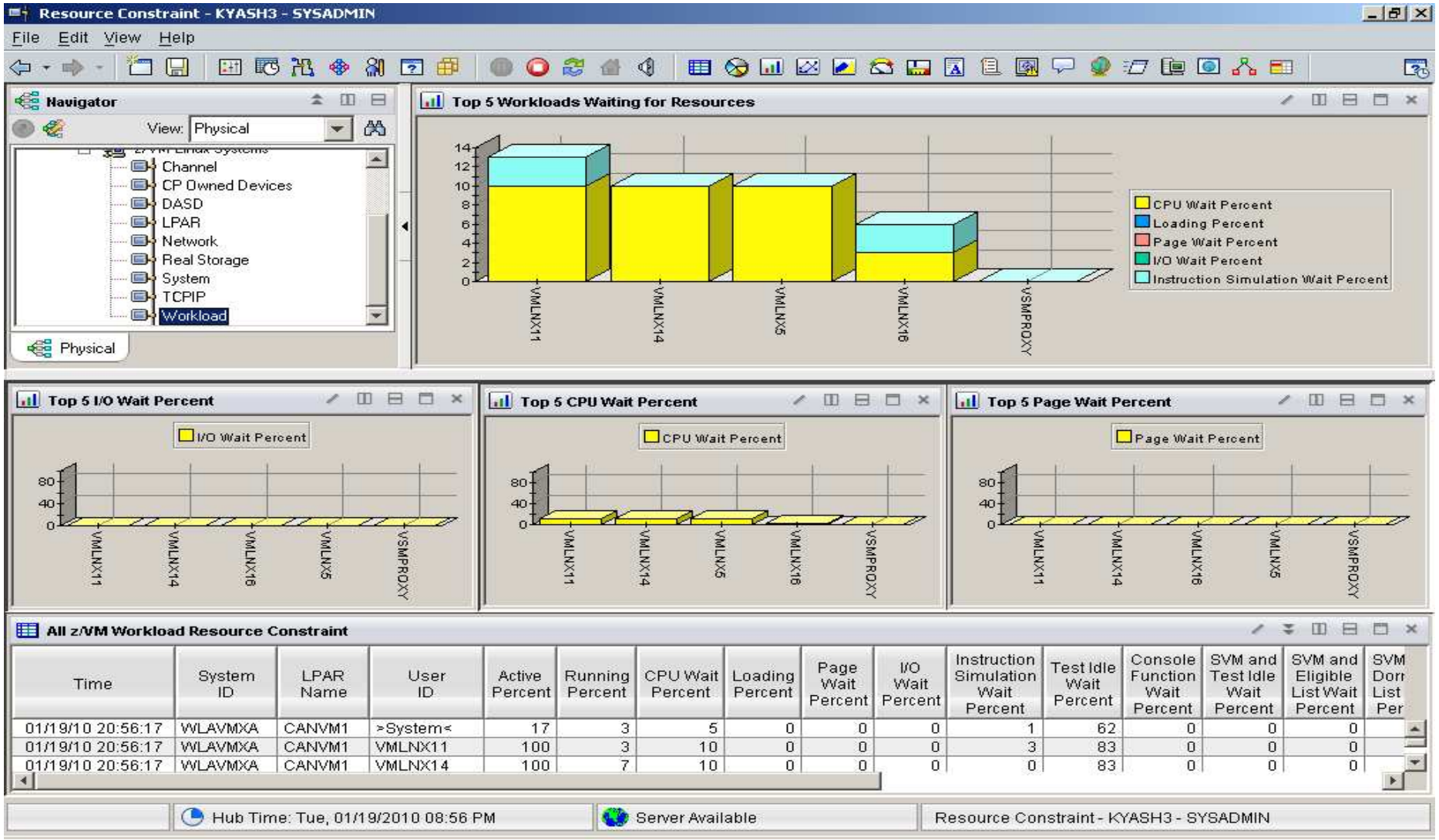
- Wait and see if anyone complains
- Dig around and look at several other metrics
- Move or stop guests
- Add more hardware if consistently high

Final solution

Monitoring tool

- Look at resource constraint analysis
- Which guests are waiting on which resources
- Is a critical guest impacted?
- Efficient use of resources?

Resource Constraint Analysis



Time	System ID	LPAR Name	User ID	Active Percent	Running Percent	CPU Wait Percent	Loading Percent	Page Wait Percent	I/O Wait Percent	Instruction Simulation Wait Percent	Test Idle Wait Percent	Console Function Wait Percent	SVM and Test Idle Wait Percent	SVM and Eligible List Wait Percent	SVM Dorr List Per
01/19/10 20:56:17	WLAVMXA	CANVM1	>System<	17	3	5	0	0	0	1	62	0	0	0	
01/19/10 20:56:17	WLAVMXA	CANVM1	VMLNX11	100	3	10	0	0	0	3	83	0	0	0	
01/19/10 20:56:17	WLAVMXA	CANVM1	VMLNX14	100	7	10	0	0	0	0	83	0	0	0	

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

Provide Service Offering to Agencies

Challenges – *staff-up or tool up?*

Very limited in-house z/VM expertise – must leverage existing z Systems skills

No budget to staff a new z/VM team, or train potential new customers on z/VM

Robust disaster recovery solution already in place; this new service must be 100% compatible

z Systems automation principles in place – Automate, Automate, Automate as much as possible

Monitoring and Management

First take care of the simple, yet important stuff

Monitor and manage the infrastructure
How?

Scheduler
Integrated, powerful, rule based – very important!

True system event monitoring
No polling, no heart-beats, no agents

Take actions
Commands, REXX scripts, chain other take actions (automation de-dupe!)

Notification
Today e-mail, next up: SNMP alerts to inform Security Information and Event Management (SIEM) system

Backup and Recovery

Backing up this new environment

Backup and Restore Requirements

Must integrate into existing z Systems environment
VTS grid across two datacenters

Native full and incremental backup & restore
z/VM file level backup & restore a must!

Flexible selection criteria
Define once and let naming standards take care of growth (new Linux servers, new DASD, new minidisks)

Integrate with Automation
Schedule, monitor, notification

Easy!
So easy to use that this guy could do it

Provide Service Offering to Agencies

Challenges – *staff-up or tool up?*

Tool up!

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

Initial Solution

Look at performance data for the Linux guest

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

Final solution

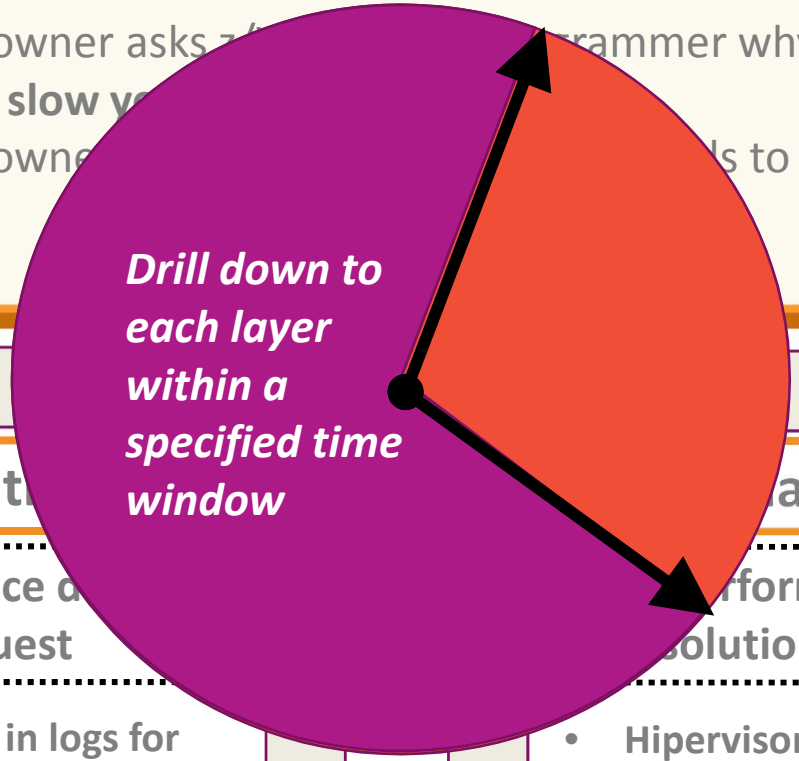
One performance monitoring solution for all layers

- **Hipervisor**
- **Linux operating system**
- **Application**

Why Was an Application Running Slow

The Situation:

- Application owner asks z/ rammer why **application** was running **slow y**
- Application owne ls to research the problem



Initial Solut al solution

Look at performance d the Linux guest

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

rformance monitoring olution for all layers

- **Hipervisor**
- **Linux operating system**
- **Application**

Why Was an Application Running Slow

z/VM

Linux on z Systems

DB2 UDB Agent

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

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

EREP
SMTP
DIRMAINT
…

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

The Solutions

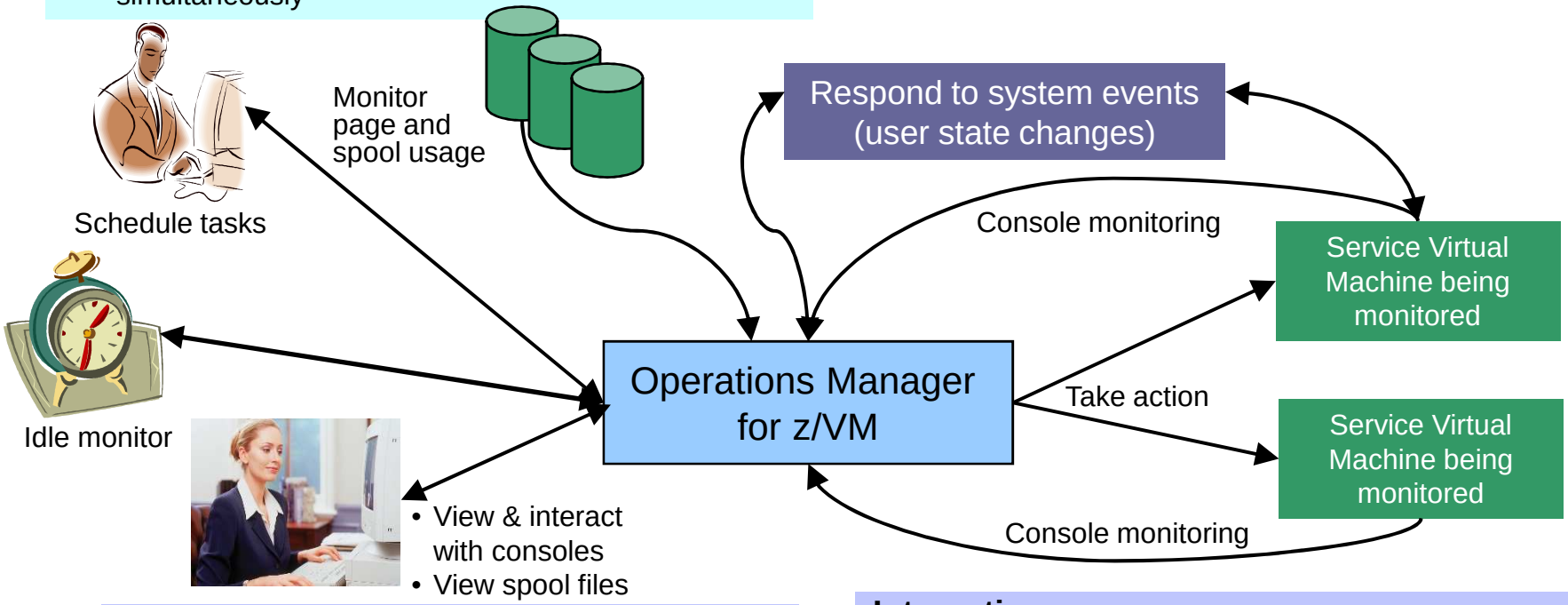
IBM Infrastructure Suite for z/VM and Linux

- Bundle/suite of IBM products
- Announced and available September 2014
- 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
  - Tivoli Storage Manager Extended Edition (now Spectrum Protect)
- Discounted price as a bundle
- Website:
  - http://www.ibm.com/software/products/en/ibm-infrastructure-suite-for-zvm-and-linux
- DeveloperWorks Wiki
  - https://www.ibm.com/developerworks/community/wikis/home?lang=en#!/wiki/W9b511b099ded_4e32_abfb_ed8ce4da5b17

Operations Manager for z/VM

Increase productivity
- Authorized users to view and interact with monitored virtual machines without logging onto them
- Multiple users view/interact with a virtual machine simultaneously

Improve system availability
- Monitor virtual machines and processes
- Take automated actions based on console messages
- Reduce problems due to operator error



Automation
- Routine activities done more effectively with minimal operations staff
- Schedule tasks to occur on a regular basis

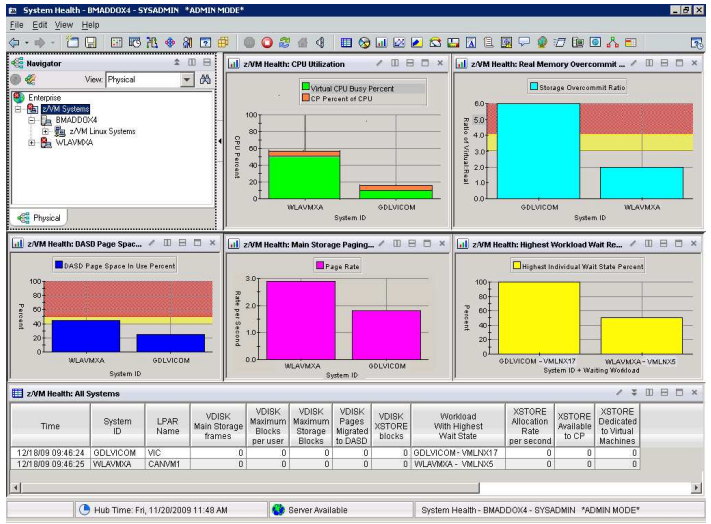
Integration
- Fulfill take action requests from performance monitoring products (e.g. OMEGAMON XE on z/VM and Linux)
- Send alerts to email, central event management systems (e.g. Netcool/OMNIbus), etc.

OMEGAMON XE on z/VM and Linux

Bringing z/VM and Linux monitoring into the Enterprise View

Enterprise-ready

cloud monitoring



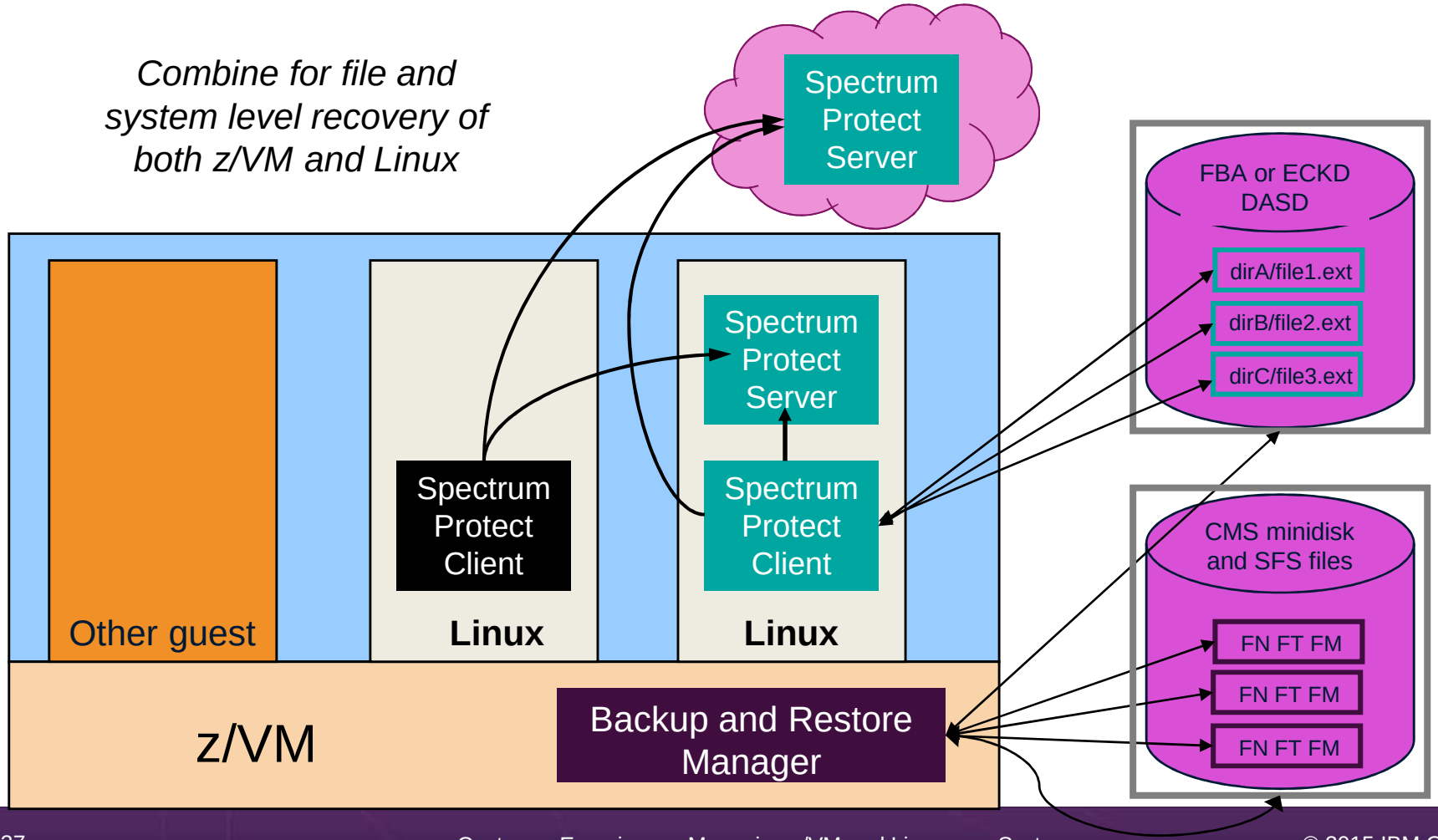
Increased Performance & Availability

- Provides **insight** into the health and performance of z/VM and Linux
- Rich collections of attributes monitor thresholds for z/VM and Linux best practices
- **Reflex automation** provides timely resolution and/or notification
- Lightweight **visibility** to the z/VM hypervisor, Linux OS, and Linux Log data in one tool
- **Deep integration** with IBM Tivoli Monitoring and OMEGAMON family, bringing z/VM and Linux data to the Enterprise view (cross platform workflow management)
- Persistent **historical views** allows management of real and virtual resources across peak periods and downtimes for **clear view** of resource usage and constraints

Backup and Restore Manager for z/VM and Spectrum Protect

Using Backup and Restore Manager with Spectrum Protect (formerly Tivoli Storage Manager)

Combine for file and system level recovery of both z/VM and Linux



Tape Manager for z/VM

- Manage tapes
  - Define tapes in a catalog
    - Free or used
    - Retention/expiration information
    - ATL/VTS or manual mount
    - Data Security Erase
  - Group tapes together into pools
    - Ownership and access control
    - Media type
- Manage devices
  - ATL/VTS
  - Manual mount
  - Tape grid/cluster
- Share devices with other systems
- Support for multiple vendors
  - IBM
  - Oracle STK
  - EMC

- **Manage mount requests**
- **Volume specific and scratch requests**
  - Standard Label
  - Non-Label
  - Bypass Label Processing

Summary and Reference Information

- Production systems need
  - Monitoring – operational and performance
  - Automation
  - Backup and recovery
- Real situations need to be addressed
  - Learn from others
- Solutions exist
  - https://www.ibm.com/developerworks/community/wikis/home?lang=en#!/wiki/W9b511b099ded_4e32_abfb_ed8ce4da5b17
- Contact
  - Tracy Dean, tld1@us.ibm.com

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. Archiving 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

Scenario 3b: Send an Alert to OMNIbus – Using SNMP

- Watch all monitored consoles for an error message that includes the word “read-only”
- If this word appears on a console
  - Change the message to red and hold it
  - Send an alert to OMNIbus, using SNMPTRAP command on z/VM
  - Automatically unhold the message after 4 minutes
- Dynamically include in the alert
  - IP address of the z/VM system where the error occurred
  - User ID that received the error message
  - Text of the error message

Scenario 4b: Send an Email if Spool Usage is Too High

- Operations Manager monitors the spool usage (percent full)
  - Demo monitor requires spool to only be 5% full or higher
  - Usage exceeds the specified limit
  - Automatically send an e-mail to someone who can evaluate and take action
  - For demo purposes
    - Spool monitor is currently suspended
    - Dynamically resume (re-activate) the spool monitor
    - Suspend (de-activate) the spool monitor when complete

धन्यवाद
Hindi

多謝
Traditional Chinese

감사합니다
Korean

Спасибо
Russian

Gracias
Spanish

Thank
English
You

Obrigado
Brazilian Portuguese

شكراً
Arabic

Danke
German

多谢
Simplified Chinese

Grazie
Italian

Merci
French

நன்றி
Tamil

ありがとうございました
Japanese

ขอบคุณ
Thai