Customer Experiences:
Managing the z/VM and Linux on z Systems Infrastructure

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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
- Demos
- Summary and reference information
- Hands-on Lab
  - Managing a z/VM and Linux on z Systems Environment Using IBM Solutions
  - Tuesday: 04:30 PM - 05:30 PM, Asia 5
What is “Managing” and What Tools Can I Use?
### Three Dimensions of Systems Management

<table>
<thead>
<tr>
<th>Who is doing the managing?</th>
<th>Skills</th>
</tr>
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<tbody>
<tr>
<td>Application Owner</td>
<td>z/VM System</td>
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<td></td>
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<tr>
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What are they managing?
### Three Dimensions of Systems Management

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- Who is doing the managing?
  - Application Owner
  - Middleware Administrator
  - Linux System Administrator
  - z/VM System Programmer

- Skills
  - z/VM System
  - Linux Virtual Machine
  - Middleware
  - Applications

- What are they managing?

---

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

IBM Wave for z/VM
IBM Cloud Manager with OpenStack
Vendor solutions
Homegrown tools
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
Monitor performance based on best practices

- Virtual CPU for each guest
- z/VM processor utilization
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- Virtual disk utilization
- Virtual storage utilization with V/R memory ratio
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Use historical tools
- Understand capacity
- Size Linux guests for best performance in a hosted environment

- IBM OMEGAMON XE on z/VM and Linux
- Homegrown tools
- IBM Performance Toolkit for z/VM
- Vendor solutions
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 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
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IBM Operations Manager for z/VM
Vendor solutions
IBM Wakeup, PROP, *VMEVENT, *MSG, etc
Homegrown tools

Homegrown tools
IBM Operations Manager for z/VM
Vendor solutions
IBM Wakeup, PROP, *VMEVENT, *MSG, etc
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

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

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

- Homegrown tools

- IBM DDR

- IBM Spectrum Protect (aka Tivoli Storage Manager)

- IBM Backup and Restore Manager for z/VM

- Vendor solutions
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

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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 on disk
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

OPERATOR

CP SECUSER

Console Monitor (Operations Mgr)

CP MSGNOH or TCP/IP

DIRMAINT

OPERATOR

CP SECUSER

Console Monitor (Operations Mgr)

CP MSGNOH

OPERMSGS

Urgent Message 1a
Abend Message 2b
Mount Message 3a
Urgent Message 1b
Abend Message 2a
Mount Message 3b

ADMIN1

z/VM A

z/VM B

LINUX01

LINUX02

CP SECUSER

CP MSGNOH

LX2 Urgent Msg 1b
LX2 Message 2b
LX2 Message 3b

DIR Message 1b
DIR Abend Msg 2b
DIR Message 3b

CP SECUSER

CP MSGNOH

DIR Message 1b
DIR Abend Msg 2b
DIR Message 3b

CP SECUSER

CP MSGNOH

DIR Message 1b
DIR Abend Msg 2b
DIR Message 3b
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

## Resource Constraint - KYASH3 - SYSADMIN

### Navigator
- Workload
- LPAR
- Network
- Real Storage
- System
- TCP/IP
- CP Owned Devices
- DASD
- Device

### Top 5 Workloads Waiting for Resources

<table>
<thead>
<tr>
<th>Workload</th>
<th>CPU Wait Percent</th>
<th>Loading Percent</th>
<th>Page Wait Percent</th>
<th>I/O Wait Percent</th>
<th>Instructions Simulation Wait Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workload1</td>
<td>14</td>
<td>12</td>
<td>10</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Workload2</td>
<td>13</td>
<td>11</td>
<td>9</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Workload3</td>
<td>12</td>
<td>10</td>
<td>8</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Workload4</td>
<td>11</td>
<td>9</td>
<td>7</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Workload5</td>
<td>10</td>
<td>8</td>
<td>6</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

### Top 5 I/O Wait Percent

<table>
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<tr>
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<tr>
<td>Workload5</td>
</tr>
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</table>

### All z/VM Workload Resource Constraint

<table>
<thead>
<tr>
<th>Time</th>
<th>System ID</th>
<th>LPAR Name</th>
<th>User ID</th>
<th>Active Percent</th>
<th>Running Percent</th>
<th>CPU/Wait Percent</th>
<th>Loading Percent</th>
<th>Page Wait Percent</th>
<th>I/O Wait Percent</th>
<th>Instruction Simulation Wait Percent</th>
<th>Test Idle Percent</th>
<th>Console Function Wait Percent</th>
<th>SVM and Test Idle Wait Percent</th>
<th>SVM and Slight Wait Percent</th>
<th>SVM and Empty List Wait Percent</th>
<th>SVM and Busy List Wait Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>01/10/13 20:58:17</td>
<td>WLM/WX3A</td>
<td>CAN/M1</td>
<td>System=</td>
<td>17</td>
<td>3</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>62</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>01/10/13 20:58:17</td>
<td>WLM/WX3A</td>
<td>CAN/M1</td>
<td>VML/NX11</td>
<td>100</td>
<td>3</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>83</td>
<td>0</td>
<td>0</td>
<td>0</td>
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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
  - Ye, it’s true

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

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

- **z Systems automation principles in place – Automate, Automate, Automate as much as possible**
  - Uh, deal with it!
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 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/VM system programmer why the application was running slowly 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.
- Drill down to each layer within a specified time window.

**Final Solution:**
- One performance monitoring solution for all layers:
  - Hipervisor
  - Linux operating system
  - Application

- Performance data in logs for the Linux operating system.
- No application data.
Why Was an Application Running Slow

- 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

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

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

**Increased Performance & Availability**

- **Enterprise-ready cloud monitoring**
- 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

Spectrum Protect Server

- FBA or ECKD DASD: dirA/file1.ext, dirB/file2.ext, dirC/file3.ext
- CMS minidisk and SFS files: FN FT FM, FN FT FM, FN FT FM

z/VM

Backup and Restore Manager

Linux

Other guest

Linux

Spectrum Protect Client

Spectrum Protect Client
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
- 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