
How to be a Great z/VM System Programmer

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-
- Why – A Self Serving Explanation from the Development point of view
 - And it is good for you too
 - Being a Systems programmer is sort of like many things 😊
 - “Top 10” Things You Need to Know and Do
 - Initial System Setup or Planning for Changes
 - Everyday Items
 - Occasional Items
 - Prepared Responses to Catastrophic Events
 - Learning More

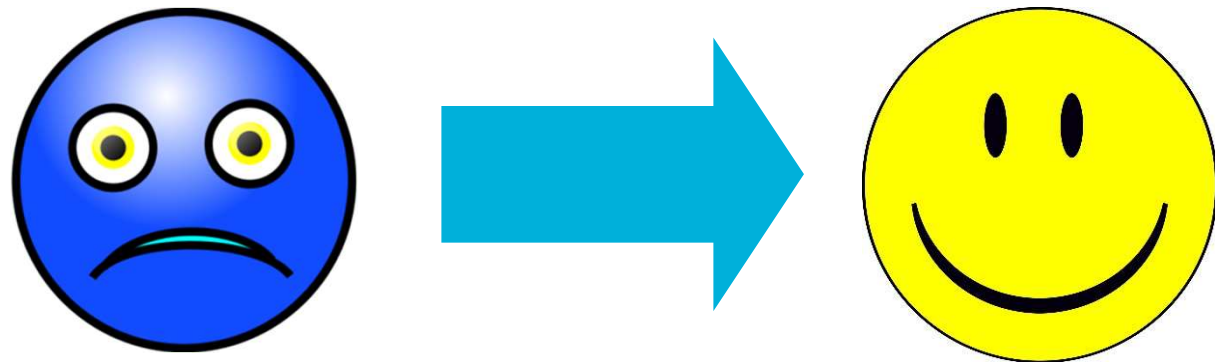
** Some URL's are not referenced in each section of this presentation, but rather are all together in a reference page at the end.

“Top 10” things you need to know and do

Suggestions that will help us all



- Some history of how we got to this presentation
- Smart people thrust into uncomfortable waters
- Some situations we have seen
 - Unknown outages (outages without any Documentation or Known Cause)
 - Configuration
 - Performance



“Top 10” things you need to know and do

Good Better Best



- Good – You have more than thought about the topic but the response is mostly manual and ad-hoc
- Better – You have a plan and are taking the steps necessary to carry it out.
- Best – You have a well thought out methodology. Many of the responses are automated and documented so they are repeatable.
 - You learn from the past

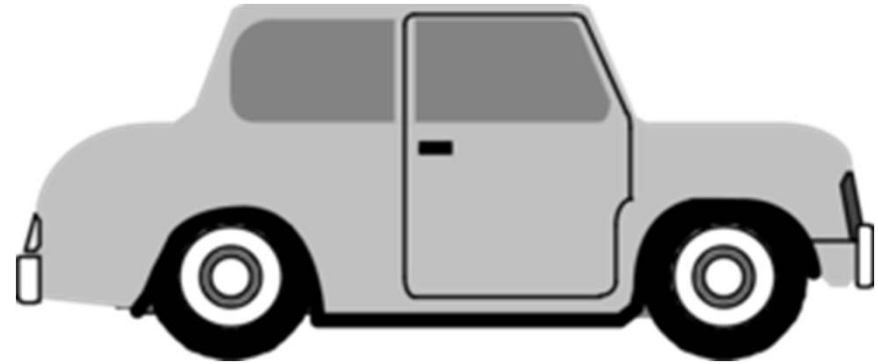


“Top 10” things you need to know and do

Like your car



- The day you bring it home
- Daily needs
- Weekly needs
- Occasional needs

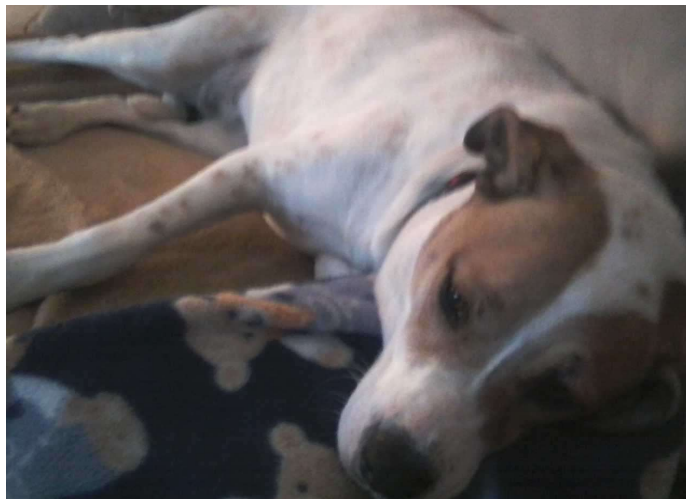


“Top 10” things you need to know and do

Like your pets



- The day you bring it home
- Daily needs
- Weekly needs
- Occasional needs



“Top 10” things you need to know and do

Like your Personal Relationships



- The day you bring “it” home
- Daily needs
- Weekly needs
- Occasional needs



“Top 10” things you need to know and do

What are the “Top 10”?



- ▶ Security policy
- ▶ Configuration – Storage, Network, etc.
- ▶ Backups
- ▶ Paging and Spooling space
- ▶ Performance
- ▶ Virtual Machine management
- ▶ Logging
- ▶ Social factors
- ▶ Maintenance (applying service)
- ▶ Handling outages – Disaster Recovery, abends



-
- Initial System Setup or Planning for Changes
 - Everyday Items
 - Occasional Items
 - Prepared Responses to Catastrophic Events

“Top 10” things you need to know and do

Change Installation Passwords



- z/VM and many products deliver with common passwords
 - These absolutely need to be changed
 - Passwords for other installed products
- ▶ Before moving your system into production, you should ensure all passwords conform to your corporate security policies.
 - ▶ It can be embarrassing or worse
- ▶ Other Material
 - ▶ CP Planning and Administration manual **

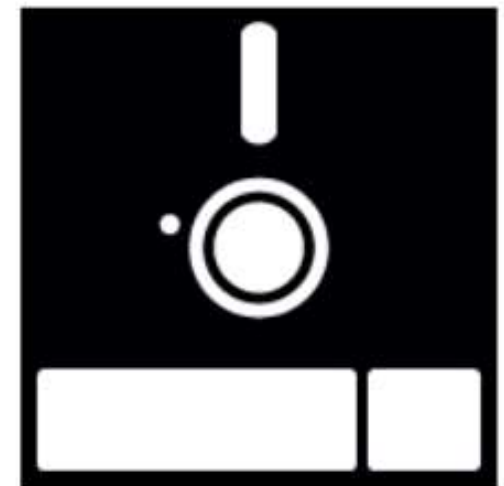


“Top 10” things you need to know and do

Storage Configuration (FICON DASD and FCP SCSI)



- ▶ Have a plan or work toward a plan for your storage configuration
 - ▶ Current needs and growth
 - ▶ Types of Storage
- ▶ Storage Allocation and Maintenance
 - ▶ Allocation (Standardization on Size and Device numbers) across LPARS
 - ▶ Settings and Error reporting
 - ▶ Duplicate VOLSER issues
 - ▶ Cylinder zero is special sometimes (1-END Minidisk to protect the VOLSER and allocation)
 - ▶ Advanced Configurations (e.g. GDPS)



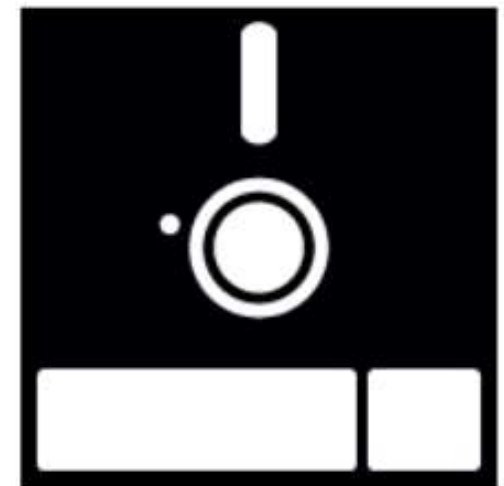
“Top 10” things you need to know and do

Storage Configuration (FICON DASD and FCP SCSI)



▶ Other Material

- ▶ CP Planning and Administration Manual **
- ▶ EREP in System Operations Manual **
- ▶ GDPS References and description page –
<http://www-03.ibm.com/systems/z/advantages/gdps/>

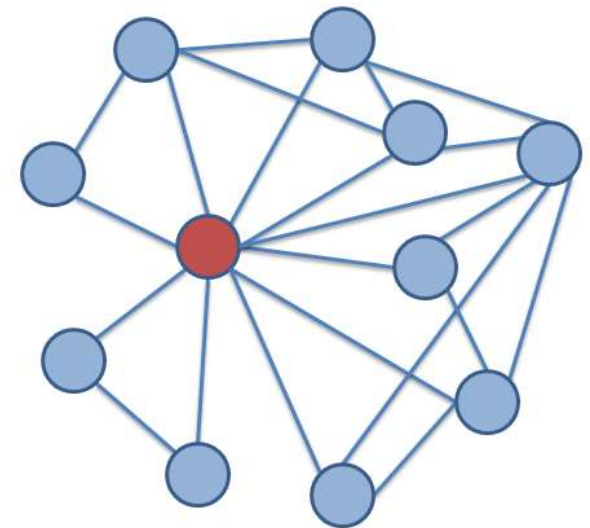


“Top 10” things you need to know and do

A Planned Network Configuration



- ▶ Your physical and logical network for z/VM is key to nearly everything
 - ▶ Server and Application Connectivity
 - ▶ Transaction time and Perceptions
 - ▶ Robustness – Built-in failover
 - ▶ VSwitch and VSwitch Link aggregation is preferred
 - ▶ Lower CPU costs
 - ▶ Operates in Ethernet (Layer 2) or IP modes (Layer 3)
 - ▶ Supports port isolation
 - ▶ Supports link aggregation
 - ▶ Involve your network team!! This is really a must
- ▶ Other Material
 - ▶ z/VM Connectivity Manual **
 - ▶ z/VM: Getting Started with Linux on IBM Z **
 - ▶ Linux on System z Tuning Hints and Tips for Networking – <http://www.ibm.com/developerworks/linux/linux390/perf/>



“Top 10” things you need to know and do *BACKUP of z/VM and Server data*



- ▶ Sometime and for some reason you will need to restore data on your system. Plan on this from the beginning
 - ▶ Storage Failures
 - ▶ Application failures
 - ▶ ...
- ▶ How
 - ▶ Backups of key data – File level backup (including to email) or Device level
 - ▶ Don't backup unnecessary things (paging volumes, redundant SSI data, etc.)
 - ▶ Being able to rebuild data
 - ▶ Where to backup the data to is your choice
 - ▶ Duplicate copies of data (Flash Copy, DDR)
 - ▶ Consistent USABLE data. (with I/O Quiesced)
 - ▶ TEST YOUR BACKUPS!!!!
- ▶ CP DATA
 - ▶ SPXTAPE for Spool and System Data files
 - ▶ DDR for CP Volumes (allocation maps etc.)



“Top 10” things you need to know and do *BACKUP of z/VM and Server data*



▶ Other Material

- ▶ z/VM: Getting Started with Linux on IBM Z **
- ▶ Backup and Restore Manager for z/VM **
- ▶ Tape Manager for z/VM **
- ▶ SPXTAPE and DDR in the CP Commands Manual **
- ▶ DFSMS/VM publications in the VM Library for Tape Handling **
- ▶ Tivoli Storage Manager (now: IBM Spectrum Protect) **



-
- Initial System Setup or Planning for Changes
 - **Everyday Items**
 - Occasional Items
 - Prepared Responses to Catastrophic Events

“Top 10” things you need to know and do *Manage Paging space on the system*



- ▶ Paging space is user and system pages on External Storage
 - ▶ These pages can be a copy of what is in storage or the only copy
 - ▶ Usage changed with z/VM 6.3.0 – better performance but greater needs
 - ▶ Planning your paging allocation is important
- ▶ Paging space is not optional
 - ▶ Running out of paging will cause a System Outage (PGT004 abend)
 - ▶ Messages issued by CP at 90% & 100% also at 90% of spooling space in use as a last effort
 - ▶ Often the messages come too late for avoidance actions
 - ▶ Monitoring over time will give you a good indication
 - ▶ Commands and Tooling to watch and monitor PAGE
 - ▶ QUERY ALLOC PAGE



“Top 10” things you need to know and do *Manage Paging space on the system*



- Good – Periodic QUERY ALLOC PAGE to see where the system is regarding PAGE usage
- Better – Queries but also maintaining the history of usage so you can see trends and EXECs to monitor specifics
 - OMEGAMON can track history of Page Space Utilization
- Best – An automated solution like Operations Manager that will both visually provide the state and will Notify you if some threshold has been exceeded.
 - Catch the problem as it is changing in real time.



“Top 10” things you need to know and do

Manage Paging space on the system



▶ Other Material

- ▶ CP Planning and Administration manual – Estimation **
- ▶ Operations Manager for z/VM -
<http://www-03.ibm.com/software/products/en/operations-manager-for-zvm>



“Top 10” things you need to know and do

Keep track of System & Server Performance



- ▶ System performance is about a number of things
 - ▶ Monitoring System Performance
 - ▶ Monitoring Guest Performance
 - ▶ Making Improvements and knowing what those changes did
 - ▶ Best to have performance data before and after changes are made
 - ▶ Make one (or a very few changes) and measure
 - ▶ Predict what is next
- ▶ Things you can do
 - ▶ Commands may help but overall they do not give a good holistic picture of performance (e.g. INDICATE)
 - ▶ Collect Monitor Records – Even if you have a Performance Product you should save the data with MONWRITE
 - ▶ Use analysis products



“Top 10” things you need to know and do

Keep track of System & Server Performance



- Good – Periodic Commands to keep a pulse on the state of the running system.
 - Maintain some history
- Better – Queries and a performance product like Performance Toolkit and Tivoli OMEGAMON
- Best – A holistic approach
 - Automation via Performance product
 - Collection of MONWRITE data at least Periodically and Before / After significant change
 - Catch the problem as it is changing in real time.



“Top 10” things you need to know and do

Keep track of System & Server Performance



► Other Material

- CP Planning and Administration manual – Estimation **
- Tivoli OMEGAMON XE on z/VM and Linux
<http://www-03.ibm.com/software/products/en/tivoomegxeonzvmandlinu>
- Collecting MONWRITE Data: About as Simple as I Can Make It by Brian Wade
<http://www.vm.ibm.com/devpages/bkw/monsimp.html>
- MONCLEAN on the z/VM Download page **
- Redbook - The Virtualization Cookbook for IBM z/VM 6.3, RHEL 6.4, and SLES 11 SP3 – Section 23.3.1
<http://www.redbooks.ibm.com/redbooks/pdfs/sg248147.pdf>
- z/VM: Performance Toolkit Guide Manual **
<http://publibz.boulder.ibm.com/epubs/pdf/hcsm7c30.pdf>



“Top 10” things you need to know and do

Manage Spooling space on the system



- ▶ Spooling space in a z/VM system is required for normal operation
 - ▶ Shared Segments - NSS / DCSS – Usually are not a problem
 - ▶ Console Files – Logs from z/VM service machines
 - ▶ Files being moved from one user to another and diagnostic data

- ▶ Spool has a tendency to grow
 - ▶ Aged unprocessed files
 - ▶ Occasional Data -- DUMPS, Trace files, etc.
 - ▶ Commands and Tooling to watch and monitor SPOOL
 - ▶ QUERY ALLOC SPOOL
 - ▶ CP Messages come really late for most installations
 - ▶ Page Space Overflow (Last effort paging space)
 - ▶ You need to have a System Operator for notifications



“Top 10” things you need to know and do *Manage Spooling space on the system*



- Good – Periodic QUERY ALLOC SPOOL to see where the system is regarding SPOOL usage
 - Allocate Dedicated DUMP space
 - QUERY DUMP
- Better – Queries but also maintaining the history of usage so you can see trends
 - Run tools like SFPURGER & SPOOLPIG to determine more information
 - OMEGAMON will keep spool History
- Best – An automated solution like Operations Manager that will both visually provide the state but will Notify you if some threshold has been exceeded
 - Operations Manager can also run SFPURGER on a schedule or when thresholds have been reached
 - Catch the problem as it is changing in real time.



“Top 10” things you need to know and do

Manage Spooling space on the system



▶ Other Material

- ▶ CP Planning and Administration manual **
- ▶ SFPURGER – CMS Commands and Utilities manual **
- ▶ Operations Manager for z/VM -
<http://www-03.ibm.com/software/products/en/operations-manager-for-zvm>
- ▶ SPOOL PIG and others – z/VM Download Page **

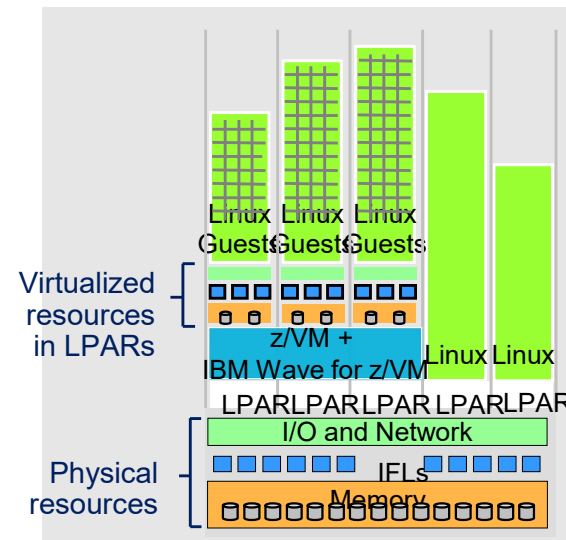


“Top 10” things you need to know and do

Monitor your Virtual Machines



- ▶ Monitoring Virtual Machines (Servers) is often needed if anyone else is working with the system
 - ▶ Two Types of servers (at least)
 - ▶ Service Virtual Machines like those shipped with z/VM tend to be relatively stable but even they can change
 - ▶ Linux Servers (Production or Test) tend to have transparent changes. (e.g. Workload, Configuration, z/VM definition etc)
 - ▶ Servers tend to grow over time
 - ▶ Knowing what is running will allow you to anticipate
- ▶ Things that you can monitor
 - ▶ QUERY NAMES – About the simplest
 - ▶ INDICATE
 - ▶ Working Set Sizes
 - ▶ Resident Pages
 - ▶ CPU Consumed
 - ▶ Remember – some changes may not take effect until the server is restarted, which might not occur for a long time

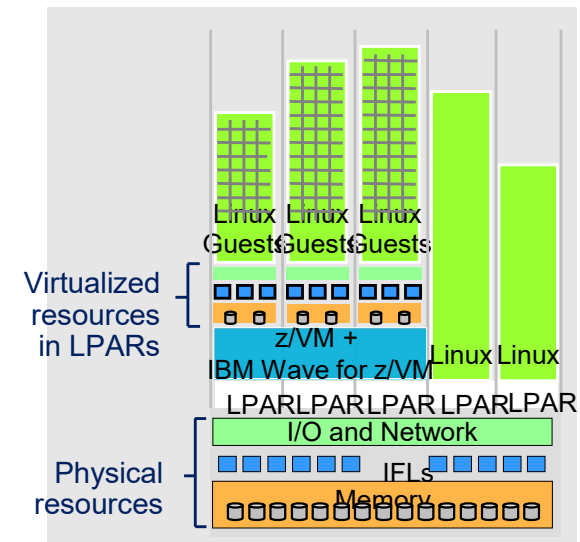


“Top 10” things you need to know and do

Monitor your Virtual Machines



- ▶ Other Material
 - ▶ CP Planning and Administration manual **
- ▶ VIR2REAL – Compute the Virtual to Real storage (memory) ratio of running users in a z/VM LPAR – z/VM Download Page **
- ▶ Tivoli OMEGAMON XE on z/VM and Linux **



“Top 10” things you need to know and do

Capture Important Console logs



- z/VM servers have valuable information in their console logs. However, you need to capture it.
 - Startup data is often captured in logs
 - Logs contain a significant amount of mundane information
 - Critical error information
 - Only guests that are logged (could be disconnected) on to the system have logs.
 - Should get at least a couple of days & initialization (more is better)
 - Gathering the logs can be done by various methods
 - Spooled Console Logs
 - Automated logs to Disk
 - Automation Products that do much of this for you
 - TERM TIMESTAMP ON – Adds a time to each entry



“Top 10” things you need to know and do

Capture Important Console logs



- Good – Ensure that Spooling of logs is enabled on all servers.
 - Spooling – Set up with COMMAND statement in users Directory Entry
 - Logging in a profile or server start-up
- Better – Monitor Spooling of logs on periodic basis.
 - Close/Purge oldest and open new Console Spool or log keeping newest.
 - EXECs that may use FOR command to remotely do this
- Best – An automated solution like Operations Manager will automatically save and manage server machine consoles and logs, and optionally notify you of critical events
 - Operations Manager VIEWCON tool allows for real time viewing of events that may also make management easier



“Top 10” things you need to know and do

Capture Important Console logs



- Other Material
 - The basics on gathering a Console log in the z/VM Diagnosis guide at: <http://publibz.boulder.ibm.com/epubs/pdf/hcsa5c31.pdf>
 - Operations Manager for z/VM **



“Top 10” things you need to know and do

Mainframe Social -



- Be Social – This is not a full time task but it really can help
 - Watch what is being done by others
 - Contribute your own thoughts and ideas
 - Ask Questions
 - Walking around – Virtually or Physically
- ▶ There are many avenues for material
 - ▶ List Servers, Web groups (IBMVM and LINUX-390 LISTSERVs for questions, advice, lessons learned, answers, banter, etc.)
 - ▶ Available 24 / 7 / 365
 - ▶ Relatively low traffic, low spam, little bad advice
 - ▶ Friendly, helpful, potential for lasting contacts
- ▶ Other Material
 - ▶ VM Community
 - <http://www.vm.ibm.com/techinfo/forums.html>



- Initial System Setup
- Everyday Items
- Occasional Items
- Prepared Responses to Catastrophic Events

“Top 10” things you need to know and do

Changing *SYSTEM CONFIG* – As safely as possible



- ▶ **SYSTEM CONFIG**
 - ▶ Defines your system configuration
 - ▶ On PMAINT CF0
- ▶ Develop a process for changes and stick to it. Suggested steps:
 - ▶ Make a backup copy before changing anything. This backup can be used in an emergency from the SAPL panel. Save backup in a place you can access in an emergency
 - ▶ Have a peer review your changes
 - ▶ Without fail, run CPSYNTAX !!!
- ▶ Changes not effective until next IPL
(errors may not be discovered for months!)



“Top 10” things you need to know and do

Changing SYSTEM CONFIG – As safely as possible



- ▶ CPSYNTAX Utility verifies that the SYSTEM CONFIG file is at least syntactically correct.
 - ▶ A system programmer’s best friend!
 - ▶ Available on the MAINT 193 minidisk
 - ▶ An easy way to avoid embarrassing mistakes at IPL or worse
 - ▶ Easy to run – Catches incorrect and unrecognized statements
 - ▶ Even Comment Changes
 - ▶ Corrupted SYSTEM CONFIG file problems can be very ugly and can take a long time to fix

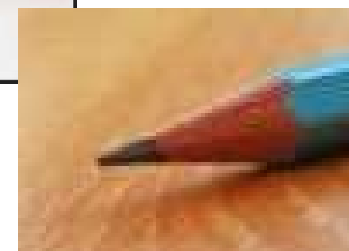


“Top 10” things you need to know and do

Changing SYSTEM CONFIG – As safe as possible



- Other Material
 - CPSYNTAX Described in the CP Commands Manual **
 - CP Planning and Administration manual **



“Top 10” things you need to know and do

Review Startup Logs for errors



- Start-up console logs may reveal errors or problems
 - ▶ Even if a server or application starts successfully there can be issues.
 - ▶ Error messages, Warnings & overrides should be reviewed
- Critical times for reviewing logs.
 - New Releases
 - Maintenance of server or application
 - Common Error messages that could be missed
 - DASD Problems Duplicate VOLID or Offline
 - Spool Problems (e.g. NSS/DCSS ...)
 - CONFIG ERRORS
- Other Material
 - CP Messages and Codes Manual **
 - Other Server manuals
 - ...

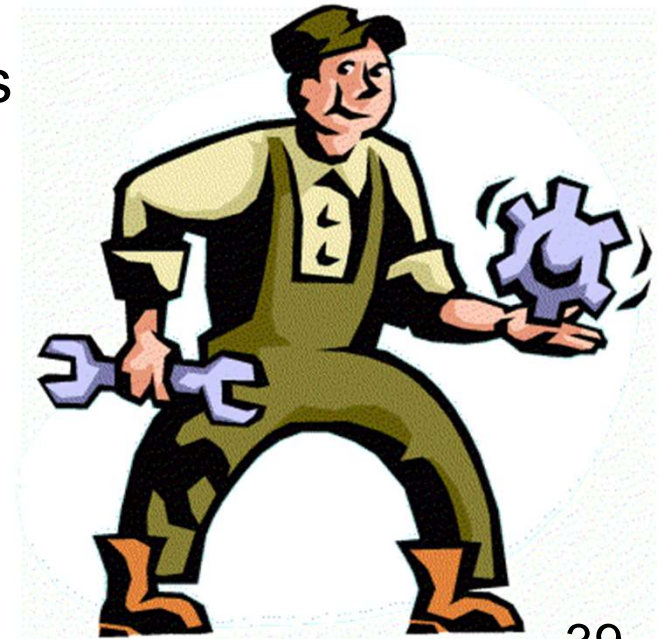


“Top 10” things you need to know and do

Maintenance is not something that can wait forever



- Have a strategy to apply z/VM maintenance at least twice a year
 - Maybe when the clocks change for Daylight Saving time
 - RSU's for z/VM are the items that we Recommend ordering / applying
 - Keep up to date no matter what your future plans are
- ▶ Just because you are ready does not mean that activating the maintenance is always required.
 - ▶ Prepare through testing 2nd level
- ▶ Urgent Service – Red Alerts and Hiper APARs



“Top 10” things you need to know and do

Maintenance is not something that can wait forever



- ▶ Apply Recommended Service Upgrade (RSU):
 - ▶ Released Periodically (6 months give or take)
 - ▶ Contains cumulative service including all pre and co-requisites in a pre-built format
 - ▶ Includes service for all integrated components and pre-installed program products
 - ▶ Available on 3590 tape, DVD, or electronically (servlink envelope)
 - ▶ Includes service required by most customer installations
 - ▶ RSUs are proven, tested, and selective

- ▶ Easy to install:
 - ▶ SERVICE
 - ▶ PUT2PROD

- ▶ Easy to remove or back out
 - ▶ SAPL – IPL from CPL OLD MODULE
 - ▶ VMSES/E - VMFREM



“Top 10” things you need to know and do

Maintenance is not something that can wait forever



- Other Material
 - RSU Page – as needed. See: <http://www.vm.ibm.com/service/rsu/>
 - Alert Page -- A great place to watch for the most important items.
To Subscribe: <http://www.vm.ibm.com/service/redalert/>
 - News -- <http://www.vm.ibm.com/service/news>
 - RSU Buckets and other maintenance is still Important
 - <http://www14.software.ibm.com/webapp/set2/psearch/search?domain=psp>



“Top 10” things you need to know and do

What is the future – Longer range



- ▶ Systems will change over time
 - ▶ Server changes (maintenance or workload changes)
 - ▶ Data Changes
 - ▶ END of Service -- End of currency UPDATE
<http://www.vm.ibm.com/techinfo/lpmigr/vmleos.html>
- ▶ Environmental changes
 - ▶ CEC changes What else is being utilized on CEC
 - ▶ Storage changes
 - ▶ Network changes
- ▶ Growth Changes
 - ▶ Additional Consolidation is a good thing but there are limits



-
- Initial System Setup
 - Everyday Items
 - Occasional Items
 - Prepared Responses to Catastrophic Events

“Top 10” things you need to know and do

Disaster Recovery



- Review/Develop your Disaster Recovery (DR) strategy
 - DR is important in ALL environments
 - DR procedures must be adjusted for SSI members
 - DR site and Home site needs to be the same. A multi-member Home needs multi-member DR or use REPAIR MODE.
 - For desperate circumstances, there is the CLEARPDR IPL parameter on the SAPL panel
 - Some Planning now will help later
- Disaster is not well defined but I am sure you will know when you experience one
 - TEST Your DR Plans



“Top 10” things you need to know and do

Prepare for z/VM Failures



- CP does not often fail but that does not mean that you should not be ready for an event
 - CP Abends – When CP discovers an unrecoverable error and Dumps
 - Incorrect Output – user is stuck in CP (hung), detected by user, etc.
 - Very Rare – CP HANG
- ▶ The goal is to Get the System Running and gather as much data as possible
 - ▶ **IMPORTANT:** Reserve dedicated dump space - DUMP option on CP_Owned statement



“Top 10” things you need to know and do

Prepare for z/VM Failures



- ▶ Dump types, methods, and behavior
 - ▶ CP abend – Dump taken and system IPLs automatically
 - ▶ SNAPDUMP command – Dump taken, system stays up. However, system is quiesced which may adversely affect servers.
 - ▶ PSW RESTART from the HMC. Dump taken and system IPLs automatically. Resultant dump appears as an SVC002 abend dump.
 - ▶ VMDUMP command – Dump of a virtual machine’s storage. Usually only requested by server support groups, but could be requested by us if it is for a second level VM system.
- ▶ WARNING: Straight “LOAD” of CP from the HMC will just IPL CP and NOT produce a dump! For all hangs, use PSW RESTART!!
- ▶ CP dumps written to OPERATNS reader (default)



“Top 10” things you need to know and do

Prepare for z/VM Failures



- ▶ Learn how to process a CP dump
 - ▶ DUMpload or DUMPLD2 utility
 - ▶ DUMPLD2 enables you to create a multi-file dump, which is easier to transfer to IBM
- ▶ Collect the OPERATOR’s console from the time of failure
- ▶ Practice moving files to and from z/VM (even copy/paste to email)
- ▶ Nearly every problem diagnosis starts with the same questions:
 - ▶ Description?
 - ▶ Release and service level?
 - ▶ What Changed (Workload, Service, HW, ...) ???



“Top 10” things you need to know and do

Prepare for z/VM Failures



- Other Material

- z/VM: Diagnosis Guide **
- Software Support Handbook
<http://www14.software.ibm.com/webapp/set2/sas/f/handbook/home.html>
- z/VM Service Resources <http://www.vm.ibm.com/service/>



“Top 10” things you need to know and do

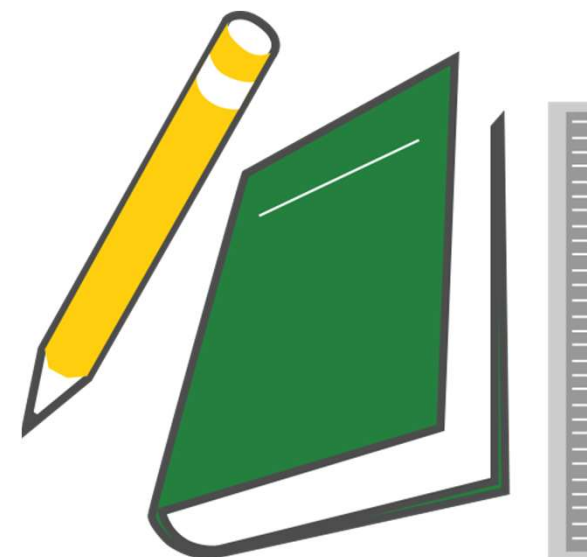
Your own education and that of your peers



- ▶ Education is an ongoing process
 - ▶ THANK YOU for your interest in attending this presentation and furthering your education
 - ▶ Please continue this ongoing effort
 - ▶ Assisting a peer will make vacations much more enjoyable 😊

- ▶ Types of education
 - ▶ Workshops and Tech Conferences
 - ▶ Formal and informal classes
 - ▶ OJT and/or reading manuals or Redbooks

- ▶ Other Material
 - ▶ CP Planning and Administration manual **
 - ▶ Running guest Operating System manual **
 - ▶ Getting Started with Linux Manual **
 - ▶ The z/VM Education Page <http://www.vm.ibm.com/education/>
 - ▶ Redbooks <http://www.redbooks.ibm.com/>



More Information



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- zVM Manuals in the Knowledge center for z/VM V6.4
https://www.ibm.com/support/knowledgecenter/SSB27U_6.4.0/com.ibm.zvm.v640/zvminfoc03.htm
 - VM V6.3 Achieves Common Criteria Certification <http://www.vm.ibm.com/security/>
 - VM Download Page <http://www.vm.ibm.com/download/>
 - RSU Page – as needed <http://www.vm.ibm.com/service/rsu/>
 - Alert Page -- A great place to watch for the most important items
To Subscribe: <http://www.vm.ibm.com/service/redalert/>
 - z/VM: Performance Toolkit Guide and Reference
https://www.ibm.com/support/knowledgecenter/SSB27U_6.4.0/com.ibm.zvm.v640.pdf/pdf.htm#zvmperfk
 - VM Service News <http://www.vm.ibm.com/service/news>
 - ▶ RSU Buckets and other maintenance is still Important
<http://www14.software.ibm.com/webapp/set2/psearch/search?domain=psp>
 - GDPS Reference page
<http://www-03.ibm.com/systems/z/advantages/gdps/>
 - Operations Manager for z/VM
<http://www-03.ibm.com/software/products/en/operations-manager-for-zvm>
 - Tivoli OMEGAMON XE on z/VM and Linux
<http://www-03.ibm.com/software/products/en/tivoomegxeonzvmandlinu>
 - Tivoli Tivoli Storage Manager (now: IBM Spectrum Protect)
<http://www-03.ibm.com/software/products/en/tivostormana>
 - z/VM Glossary
<http://publibz.boulder.ibm.com/epubs/pdf/hcsl9c30.pdf>
 - z/VM Migration Guide
<http://publibz.boulder.ibm.com/epubs/pdf/hcsf9c32.pdf>

Web sites:

- <http://www.vm.ibm.com/> -- zVM on the Web
- <http://www.vm.ibm.com/library> -- the online zVM Library
- <http://www.vm.ibm.com/education> -- presentations, classes and information

Via mailing lists:

- IBMTCP-L@VM.MARIST.EDU
- IBMVM@LISTSERV.UARK.EDU
- LINUX-390@VM.MARIST.EDU

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Dank u
Dutch

Merci
French

Спасибо
Russian

Gracias
Spanish

شكراً
Arabic

धन्यवाद
Hindi

감사합니다
Korean
תודה רבה
Hebrew

Tack så mycket
Swedish

Obrigado
Brazilian
Portuguese

Dankon
Esperanto

Thank You

谢谢
Chinese

ありがとうございます
Japanese

Trugarez
Breton

Danke
German

Tak
Danish

Grazie
Italian

நன்றி
Tamil

děkuji
Czech

ขอบคุณ
Thai

go raibh maith agat
Gaelic