The Virtualization Cookbooks: Jumpstarting a Linux under z/VM Proof of Concept

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Session 9216
Abstract

Three updated books are available with titles: *z/VM and Linux on IBM System z: The Virtualization Cookbook for <Distro>* where Distro is **SLES 9**, SLES 10 and RHEL 5. The goal of these books is to allow you to install and configure z/VM, install and configure Linux and be cloning Linux in two or three working days. Rexx EXECs and shell scripts are provided with the book to make this goal a reality. This presentation will describe the two books on the SuSE Linux Enterprise Servers (SLES). A new simple Web Application for monitoring your Linux servers and VM system will be described. This presentation will also give a live demonstration of the Linux cloning process and the new Web application.
Outline - by book chapters (common)

1. Introduction to z/VM and Linux
2. Planning
3. Configuring a desktop machine
4. Installing and configuring z/VM
5. Servicing z/VM
6. Configuring an NFS server
7. Installing and configuring Linux
8. Configuring Linux for cloning
9. Installing Linux with kickstart (RH5 book only)
10. Servicing Linux with Red Hat Network (RH5 book only)
11. Cloning open source virtual servers
12. Miscellaneous Recipes
13. Monitoring z/VM and Linux
14. Backup and restore
Who am I?, who are you?

- Mike MacIsaac, mikemac@us.ibm.com
  - 20 years at IBM in NY
  - Programmer
  - OS/390, USS, Redbook project lead
  - Marketing technical support of z/VM, Linux, IBM software, ...
  - Wrote much of the *z/VM and Linux on zSeries: Virtualization Cookbooks*

Who are you?

- Experience with this book:
  - Have you tried the steps in this book?
  - Thinking about using this book?
  - Never heard of this book
- IT status:
  - Do you have Linux and z/VM in production?
  - In test?
  - Planning a proof of concept?
- Couldn't find a better talk to go to?
- Something you are hoping to get out of this talk?
Timeline: Redbooks and whitebooks

1. Redbook published *From LPAR to Virtual Servers in Two Days*, SG24-6695-00: 6/05
2. The Virtualization Cookbook published on linuxvm.org, 2/06
3. Redbook published *The Virtualization Cookbook for SLES9*, SG24-6695-01, 4/06
4. Redbook: *The Virtualization Cookbook for RHEL4*, SG24-7272-00, 9/06
5. The Virtualization Cookbook 2 published on linuxvm.org, 8/06
6. The Virtualization Cookbook(s) for RHEL 5 and SLES 10, 2/07
7. Announcing!
Introduction:

- History: project started 2004: impetus from a zBLC working group
  - Wanted Linux on System z to be appliance-like

- Philosophy
  - Cookbook to install/customize z/VM, install/customize Linux, and clone virtual servers
  - *Everything should be made as simple as possible, but not simpler.* - Albert Einstein
  - Reader (sysadmin) wants to understand all steps, takes ownership
  - Open "source" - free as in beer, free as in liberty

- What is new?
  - Two new cookbooks for RHEL 5, SLES 10
  - 2 VDISK swaps/server => larger root file system
  - Associated controller files are an RPM
  - New section *Centralizing home directories for LDAP users* - brings together:
    - Cloning, LDAP + PAM + NSS, NFS + automount of /home/
  - New section *Rescuing a Linux system*
  - Web application to monitor/log system: Data About z/VM and Linux (DAZL)
  - `clone.sh` script (now in /sbin/) is updated:
    - Added code to create one line description file
    - Removed hard-coded reference to the master image’s mount point
    - Master image minidisk is now a variable ($sdisk)
  - Installing z/VM onto 3390-9s is addressed
Overview (cont'd):

- What has been removed?
  - Cloning IBM middleware
    - Hope to add back to SLES 10 book soon, RHEL 5 book eventually (???)
  - DCSS/XIP2

- Choices made:
  - "Roll your own" cloning rather than other products
  - Other solutions are all valid, more sophisticated, more complex
  - USER DIRECT file over directory maintenance products
  - z/VM user ID must be predefined in order to clone
  - ECKD DASD - no SCSI/FCP disks
  - Read/write /usr/ file system over shared read/only
  - Cloning and manual install hinge on CMS parameter files
  - Cloning done from Linux, no VM service machine needed

- Many usability tests conducted
  - Completion now takes about 4 days

- Get the books free on the Web at:
  - http://linuxvm.org/present/
LPAR 2: z/VM 5.2 on a z9

MAINT: SYSTEM CONFIG (CF1), USER DIRECT(2CC)
TCPMAINT: SYSTEM DTCPARMS (198)
TCPIP: <system_ID> TCPIP (TCPMAINT 198)
AUTOLOG1: PROFILE EXEC (191)
DTCVSW1 and DTCVSW2: VSWITCH controllers
LNXMAINT: CMS files on 192
SLES10 or RHEL5 master image (100), controller (200)
LINUX01: A Web server
LINUX02: An LDAP server
LINUX03: A File server
LINUX04: An application development server

Resources:
CPU: 2 IFLs, shared
Memory: 3GB/1GB
Disk: 24 3390-3 DASD
Network: 16 OSA-E addresses
TCP/IP 8 TCP/IP addresses

OSA Express
OSA Express

Physical switch

PC Linux
NFS server
Desktop machine
Planning - bill of materials

- **Hardware**
  - zSeries LPAR
    - 2 IFLs recommended (One is OK)
    - 3GB central:1GB expanded storage (1.5G:512M OK)
    - 24 3390-3 DASD or more (ask for 32 :))
    - Two OSA cards for HA VSWITCH (One is OK)
  - Temporary Linux PC for NFS server (or equivalent)

- **Software**
  - z/VM 5.2 on DVD (tape is OK)
  - SLES-10 or RHEL 5 Linux distro ISO images
  - Code associated with redbook - Tar files, also on:
    - http://linuxvm.org/present/

- **Networking resources**
  - TCP/IP address for z/VM
  - One TCP/IP address for each Linux (ask for 16 or more :))
  - DNS names (helpful but not required)
Conventions

- Volume labeling convention
  - Volume labels are only 6 chars
  - Using device address in last 4 chars:
    - Guarantees unique labels
    - First character is LPAR identifier
    - Second character is function (P=page, S=spool, M=minidisk)

- File naming convention
  - File that is shipped with VM/Linux - ORIG or .orig suffix
  - File that was last working - WRKS or .works

Password convention - z/VM admin, Linux admin, Linux users

- Worksheets - 2 sets of 4 worksheets
- Populated set of worksheets for examples used in the book
- Blank set of worksheets for (1) z/VM resources, (2) Linux resources, (3) z/VM DASD, (4) Linux user IDs
Configuring a desktop machine

- SSH client
  - PuTTY is described
    - Set SSH protocol to "2 only"
    - Add rows and columns
    - Save sessions

- VNC client
  - RealVNC is described

- 3270 emulator
  - Set Enter and Clear key if possible
  - Set to use 43 lines
  - Set to Reconnect after logoff
  - For Linux, x3270 is most popular
Installing and configuring z/VM

- Install z/VM from DVD
  - Install from DVD is documented in some detail
  - Use the Integrated 3270 console on HMC
- Customize TCPIP with IPWIZARD
  - Also configure FTP server
- Customize SYSTEM CONFIG
  - Define a VSWITCH
- Add 5 paging volumes
  - Use supplied CPFORMAT EXEC to format
- Create LNXMAINT for common CMS files
  - Kernels, RAMdisks, PARMfiles, etc.
- Customize system startup and shutdown
  - SHUTDOWN z/VM signals Linux servers to shutdown
  - IPL of z/VM autologs (boots) important Linux servers
- Address z/VM security issues
  - Passwords in USER DIRECT
- Backing/restore system to tape
  - No recipe
- Relabeling system volumes
**CPFORMAT EXEC**

cpformat

Synopsis:
Format one or a range of DASD as page, perm, spool or temp disk space
The label written to each DASD is V<t><xxxx> where:
<t> is type - P (page), M (perm), S (spool) or T (Temp disk)
<xxxx> is the 4 digit address

Syntax is:
```bash
   .-PAGE-.  
   >>>-CPFORMAT--.-rdev------------------.--AS---+-PERM+------------><
      | <----------------------|    '-SPOL-'  
      '-'rdev1-rdev2--------'
```

Example:
```bash
===> att <a775-a779> *  
A775-A779 ATTACHED TO MAINT  
===> cpformat <a775-a779> as page  
...  ```
Why relabel z/VM system volumes?

- Two reasons:
  - Avoid duplicate labels (esp. 520RES) if z/OS can see all DASD
  - Avoid z/VM systems from cross-referencing PAGE and SPOOL
Servicing z/VM

- Apply a Programming Temporary Fix (PTF)
- Apply a Recommended Service Upgrade (RSU)
  - Getting service via Internet FTP
  - SERVICE ALL
  - PUT2PROD
- Determining z/VM's service level
  - Adapted from ibm.com/vm pages
DASD view of z/VM

**z/VM system**
(5 volumes)

520RES  520W01  520W02  520SPL

520PAG  VPE540  VPE541  VPE640  VPE641  VPE345

**z/VM paging**
(5 volumes)

VME346

**LINUX volumes**
(next)
Configure a PC NFS server

- Installing Linux on zSeries is a chicken and egg problem
- Recommendation: install Linux on an Intel-architecture PC
- Server is a temporary NFS server (retire it after chapter 8)
- Steps:
  - Install Linux onto a PC
  - Copy files associated with this book to this NFS server
    - http://linuxvm.org/present/misc/virt-cookbook-RH5.tgz (for RHEL 5)
    - http://linuxvm.org/present/misc/virt-cookbook-S10.tgz (for SLES 10)
    - untar to /nfs/virt-cookbook-<distro>/
  - Set up an install directory under /nfs/<distro>/
  - Configure the NFS server to export these two directories
Installing and configuring Linux

- First: a conceptual diagram:
  - Controller/master user ID is dual boot
  - The `clone.sh` script copies the 100 minidisk to target user ID
Installing and configuring Linux (cont'd)

- Create new user ID - SLES10 or RHEL5 - with 7 3390-9s
- Add to z/VM startup - AUTOLOG1's PROFILE EXEC
- Prepare bootstrap files (kernel, RAMdisk, parmfiles) on LNXMAINT 192
- Install master image onto 100 with 101/102 VDISK swaps
- Configure master image
  - Create nightly.sh script
  - Adding additional RPMs
  - Configuring the VNC server
  - Preparing for Online Update
  - Removing unnecessary RPMs
  - Turning off unneeded services
  - Configuring rsyncd
  - Applying service - online update
  - Configuring sitar
  - Setting the software clock accurately
  - Setting system to halt on SIGNAL SHUTDOWN
  - Turning off the hz_timer
  - Modifying zipl.conf
- Install controller onto 200
  - 100 disk is /sles10master/, /backup/ file system, /nfs/ is 4 volume LVM (9GB)
Installing and configuring Linux (cont'd)

- Configure controller
  - Copying files to the controller
  - Adding additional RPMs
  - Configuring the VNC server
  - Removing unnecessary RPMs
  - Turning off unneeded services
  - Applying service if necessary - online update
  - Configuring sitar
  - Installing the cmsfs package
  - Turning on the NFS server
  - Turning on the NTP server
  - Enabling the vmcp module
  - Setting system to halt on SIGNAL SHUTDOWN
  - Turning off the hz_timer
  - Configuring SSH keys
  - Configuring Apache for DAZL
  - Setting ownership of Linux backup directories
Configuring NFS on the controller

- Copying files from NFS server to controller
  - Copying the SLES10 ISO images
  - Copying the files associated with this book
- Configuring the NFS server
- Changing the YaST installation location
- Retire the PC NFS server
Configuring Linux for cloning

- How to clone manually
- How to use the clone.sh script
- Both processes do about the same tasks:
  - Link target ID as 1100
  - Copy from source (100) to target (1100) - use FLASHCOPY if you have it
  - Mount copied file system
  - Modify networking info - usually just IP@ and hostname
  - Detach target disk
  - IPL new clone
  - Modify SSH keys
Cloning open source virtual servers

- Clone and customize 4 open source virtual servers
  - LINUX01 - Web server
    - apache2 RPMs
    - Turning on a firewall (RH5 book only)
    - Creating a certificate (S10 book only)
  - LINUX02 - LDAP server
    - openldap RPMs
    - Migrate /etc/ users and groups via PADL migration tools
  - LINUX03
    - File server - Samba
    - Create one new Samba user, one new file share
  - LINUX04 - Application development server
    - Python, Perl, tcl, PHP
    - C/C++
    - Java
    - etc.
Review - DASD and role view

- **z/VM system**
  - 520RES
  - 520W01
  - 520W02
  - 520SPL
  - (5 volumes)

- **z/VM paging**
  - 520PAG
  - VPE540
  - VPE541
  - VPE640
  - VPE641
  - VPE345
  - (5 volumes)

- **LNXMAINT**
  - VME346
  - 191/192: common files (320 cyl)

- **z/VM sysadm**
  - VME346
  - VME347
  - VME348
  - VME349
  - VME34C
  - <main ID> (7 volumes)
  - Linux sysadmin

- **Linux end users**
  - LINUX01
  - VME34D
  - VME542
  - VME543
  - VME544
  - VME547
  - LINUX02-07 (6 volumes)
Miscellaneous Recipes

- Other tasks you might want to do:
  - Adding a logical volume (LVM) via line commands
    - Aside: a rule of GUI administration tools:
      - *First learn line commands to perform a task and know what files are changed. Then use a GUI tool to do the same task if it is faster or more usable.*
  - Extending a logical volume via line commands
  - Centralizing home directories for LDAP users - brings together
    - LDAP in LINUX02
    - Logical volume just created
    - PAM, NSS for authentication
    - Automount NFS for "traveling" /home/
  - Rescuing a Linux system
Miscellaneous recipes (cont'd)

- **LDAP client**
  - PAM, NSS

- **NFS client**
  - automount service

- **LDAP server**
  - authentication

- **NFS server**
  - automounting

- **/var/lib/ldap**

- **/home/file system**

- **LINUX02**

- **LINUX03**

- **LINUX04**

- **LINUX05**
Monitoring z/VM and Linux

- Using the INDICATE and other basic commands
  - Using INDICATE written by Bill Bitner
  - Using other QUERY and HELP commands

- z/VM Performance Toolkit
  - How to configure basic and as a Web server
  - How to use (brief)

- Monitoring Linux - two options
  - With the Linux RMF data gatherer (aka rmfpms)
  - With APPLMON data gatherer built into SLES9 kernel

- Linux images can be registered with the Performance Toolkit

- New Web app: Data About z/VM and Linux
  - Disclaimer:
    - Not formally supported
    - Not heavily tested
    - "Quick and dirty"
  - Does not replace IBM Director!
    - See "IBM Director 5.2 on System Z with z/VM Center extensions"
      - Session 9219, Friday at 9:30
Data About z/VM and Linux (DAZL)

- Overall design:

  - **Linux controller**
    - JavaScript
    - AJAX
    - TCPMAINT
    - TCPMAINT 198, 592
    - MAINT 191, 2CC, CF1
    - TCPMAINT 198, 592

  - **Apache Web server**
    - cgi-bin/scripts
    - sudo vmcp
    - sudo ssh

  - **Browser**

  - **z/VM CP**
    - sudo ssh

  - **Linux virtual servers**
    - LINUX03
    - LINUX04
    - LINUX05

  - **z/VM minidisks**
    - CP, cmsfs
    - ssh, rsync
Monitoring z/VM and Linux (cont'd)

- DAZL Screen shots:
## DAZL Linux report:

- **DB2**
  - **Linux Host name**: lat132.pbm.host.com
  - **IP address**: 129.40.178.133
  - **Sitara data**: Cron, New
  - **Description/Log**: descLog.txt file not found

- **LINUX01**
  - **Linux Host name**: lat121.pbm.host.com
  - **IP address**: 129.40.178.121
  - **Sitara data**: Cron, New
  - **Description/Log**: This is a Web Server

- **LINUX02**
  - **Linux Host name**: lat122.pbm.host.com
  - **IP address**: 129.40.178.122
  - **Sitara data**: Cron, New
  - **Description/Log**: This is an LDAP Server

- **LINUX03**
  - **Linux Host name**: lat123.pbm.host.com
  - **IP address**: 129.40.178.123
  - **Sitara data**: Cron, New
  - **Description/Log**: This is an application development server

- **LINUX04**
  - **Linux Host name**: lat124.pbm.host.com
  - **IP address**: 129.40.178.124
  - **Sitara data**: Cron, New
  - **Description/Log**: This is a Samba Server

- **LINUX05**
  - **Linux Host name**: lat125.pbm.host.com
  - **IP address**: 129.40.178.125
  - **Sitara data**: Cron, New
  - **Description/Log**: linux05 - WAS clone

- **LINUX06**
  - **Linux Host name**: lat126.pbm.host.com
  - **IP address**: 129.40.178.126
  - **Sitara data**: Cron, New
  - **Description/Log**: linux05 - DB2 clone

- **LINUX07**
  - **Linux Host name**: lat127.pbm.host.com
  - **IP address**: 129.40.178.127
  - **Sitara data**: Cron, New
  - **Description/Log**: MQ clone
Monitoring z/VM and Linux (cont'd)

- DAZL editing in place:

<table>
<thead>
<tr>
<th>z/VM User ID</th>
<th>Linux Host name</th>
<th>IP address</th>
<th>Sitar data</th>
<th>Description/Log</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB2</td>
<td>lat133.pbm.ihost.com</td>
<td>129.40.178.133</td>
<td>Cron</td>
<td>descLog.txt: file not found</td>
</tr>
<tr>
<td>LINUX01</td>
<td>lat121.pbm.ihost.com</td>
<td>129.40.178.121</td>
<td>Cron</td>
<td>This is a Web Server</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>It was updated with the test Web Site fubar on Nov 21, 2006.</td>
</tr>
<tr>
<td>LINUX02</td>
<td>lat122.pbm.ihost.com</td>
<td>129.40.178.122</td>
<td>Cron</td>
<td>This is an LDAP Server</td>
</tr>
<tr>
<td>LINUX03</td>
<td>lat123.pbm.ihost.com</td>
<td>129.40.178.123</td>
<td>Cron</td>
<td>This is an application development server</td>
</tr>
</tbody>
</table>
Monitoring z/VM and Linux (cont'd)

- DAZL z/VM report:

![Image of DAZL z/VM report](image.png)
Live Demo

Remember:
If it's not working, just pretend it is
Resources

- Book *z/VM and Linux on System z: The Virtualization Cookbook for SLES 10*
- Files associated with the SLES 10 book
- Book *z/VM and Linux on System z: The Virtualization Cookbook for RHEL 5* (publish Feb 28?)
- Files associated with the RHEL 5 book (Feb 28?)
- *The Linux for zSeries and S/390 portal*
  - [http://linuxvm.org/](http://linuxvm.org/)
- The linux-390 list server
  - [http://www2.marist.edu/htbin/wlvindex?linux-390](http://www2.marist.edu/htbin/wlvindex?linux-390)
- Linux for zSeries and S/390 developerWorks®
- SUSE LINUX Enterprise Server 9 evaluation
- z/VM publications
- z/VM performance tips
Q: What is the answer to The Ultimate Question Of Life, the Universe and Everything? A: 42

But what is the ultimate question?