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The Cloud Computing Cookbook

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IBM STG Lab Services

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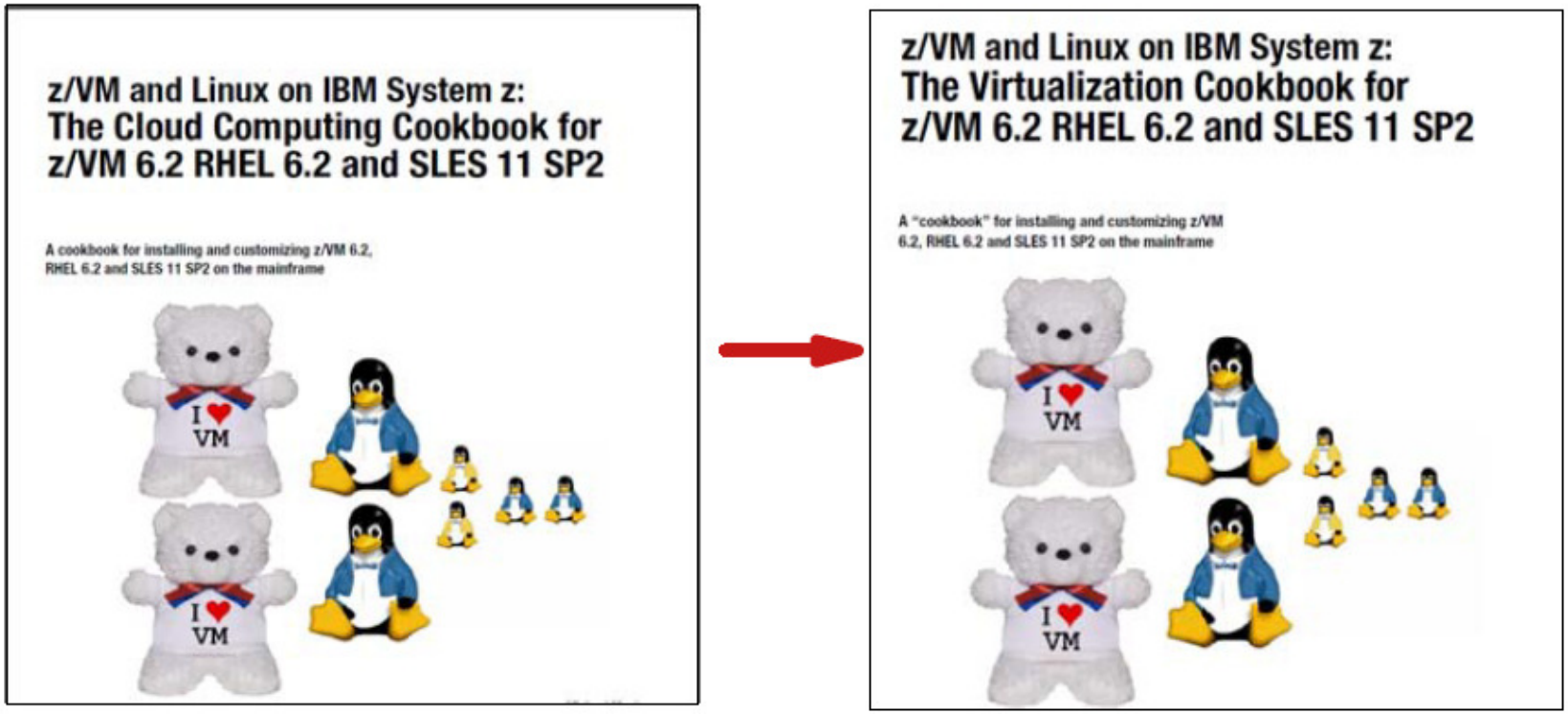
Abstract

The "Virtualization Cookbook" for System z, usually in the form of a Redbook, has been a popular reference for many years. It has been updated for 2012 and renamed "The Cloud Computing Cookbook". This presentation will focus on the latest function provided in z/VM 6.2. New sections of the book, including Live Guest Relocation, some new small REXX EXECs, enabling and using DirMaint and SMAPI, and both RHEL and SLES Linux will be addressed.

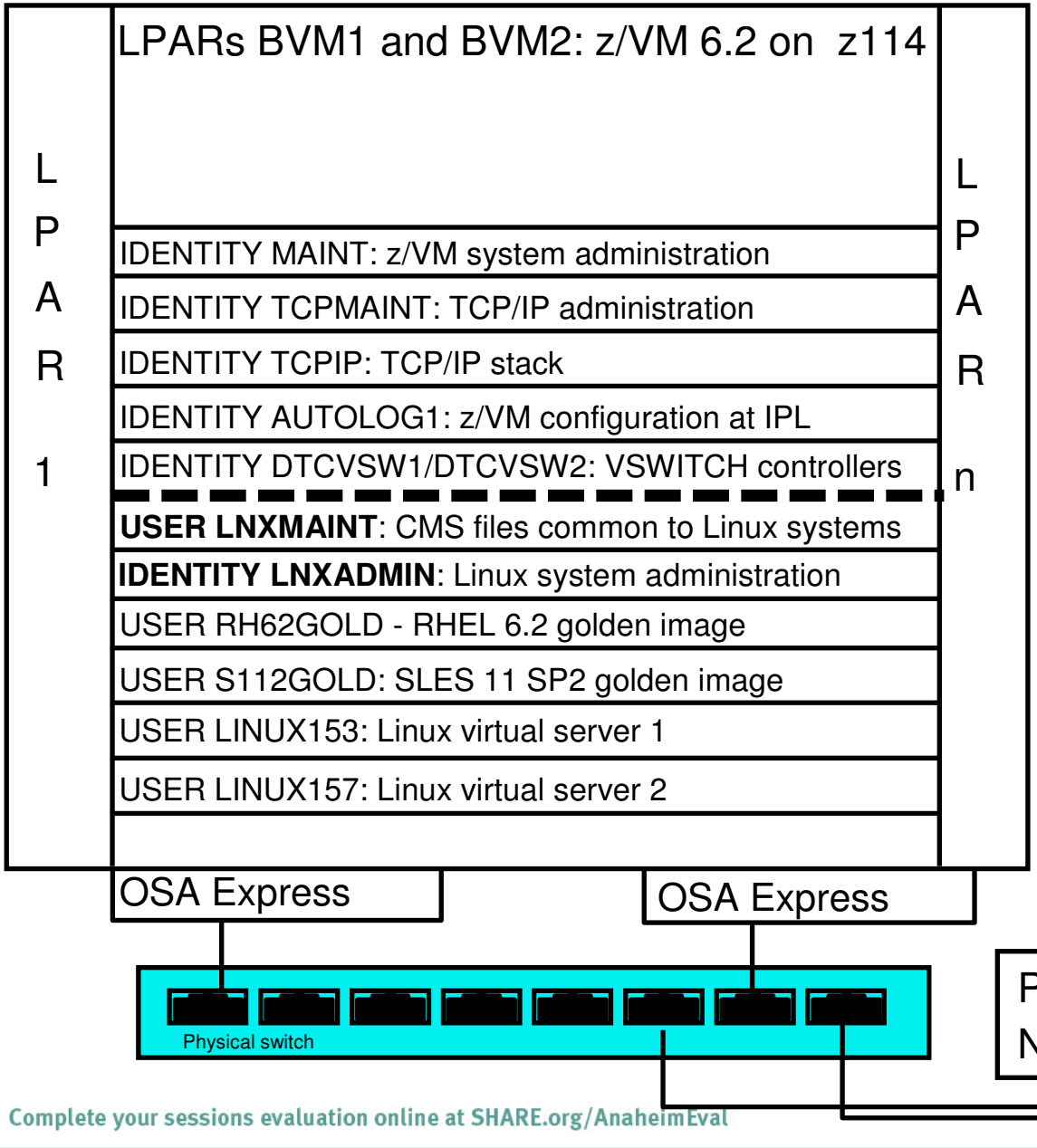
Overview

•The **Virtualization Cookbooks** and now the **Cloud Computing Cookbook** have always had the same goal in mind: to be a single source for installing and customizing z/VM, installing and customizing Linux, and getting to the point of cloning and making appliances of Linux virtual servers. Over the years, commonly used **Miscellaneous Recipes** have also been documented.



•See http://www.vm.ibm.com/devpages/mikemac/

Overview of entire system



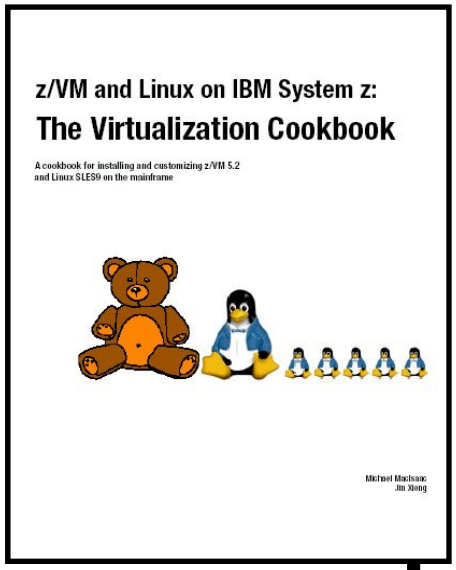
Resources:

CPU: 2 IFLs, shared
Memory: 6GB/2GB or more
Disk: 42 3390-3 DASD
Network: 16 OSA-E addresses
TCP/IP 6 TCP/IP addresses

Outline of current book

1. ***Introduction and z/VM*** - introduces z/VM 6.2, discusses planning, then installation and configuration into a two member SSI with z/VM 6.2.
2. RHEL 6.2 Linux - install, customizing and clone Red Hat Enterprise Linux (RHEL)
3. SLES 11 SP2 Linux - install, customizing and clone SuSE Linux Enterprise Server (SLES)
4. ***Other topics*** - includes chapters on:
   a. **Live Guest Relocation (LGR) between SSI members**
   b. **Configuring DirMaint, SMAPI, and RACF**
   c. Monitoring z/VM and Linux
   d. Miscellaneous “recipes”
   e. xCAT - the eXtreme Cloud Administration Toolkit
5. Appendices - includes references, cheat sheets and lists the source code

History of cookbooks



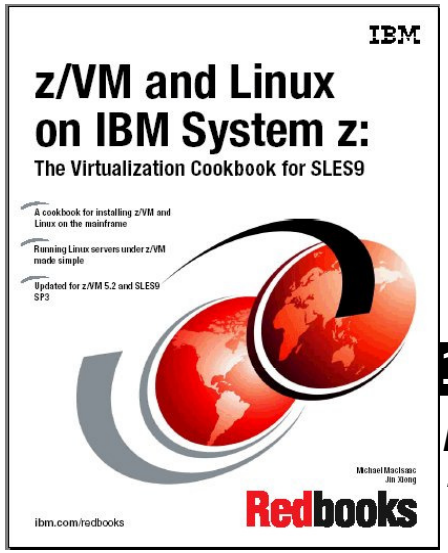
6,**7** *The Virtualization Cookbook(s) for RHEL 5 and SLES 10*, **3/07**

5 *The Virtualization Cookbook 2* [1], **8/06**

2 *The Virtualization Cookbook*, **2/06**

Project started: 11/04

2004 | 2005 | 2006 | 2007



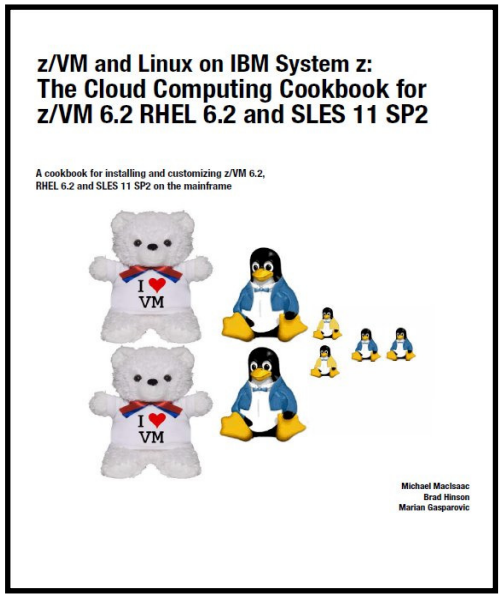
3 Redbook published *The Virtualization Cookbook for SLES9*, SG24-6695-01, **4/06**

4 Redbook: *The Virtualization Cookbook for RHEL4*, SG24-7272-00, **9/06**

1 Redbook published *From LPAR to Virtual Servers in Two Days*, SG24-6695-00: 6/05

[1] includes middleware cloning

History of books (cont'd)



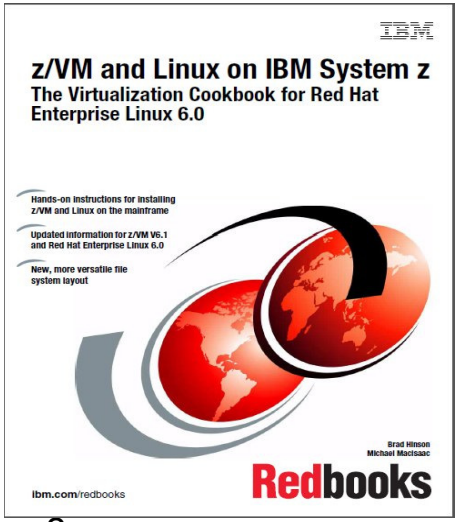
See: http://www.vm.ibm.com/devpages/mikemac/

12 *The Cloud Computing Cookbook for z/VM 6.2, RHEL 6.2 and SLES 11 SP2*, **1/12**

9 *The Virtualization Cookbook for SLES 11*, **2/10**

13 The Virtualization Cookbook for z/VM 6.2, RHEL 6.2 and SLES 11 SP2, **7/12**

2008 | 2009 | 2010 | 2011



8 Redbook: *The Virtualization Cookbook for SLES 10 SP2*[2] , **10/08**

10 Redbook: *The Virtualization Cookbook for SLES 11 SP1*, **1/11**

11 Redbook: *The Virtualization Cookbook for RHEL 6*, **2/11**

[2] includes travelling /home

Changes in the Jan 1, 2012 book

- *z/VM and Linux on IBM System z: The Cloud Computing Cookbook for z/VM 6.2 RHEL 6.2 and SLES 11 SP2* has many new sections:
  - z/VM sections are updated for 6.2 with a two member SSI setup
  - Linux sections are updated for both RHEL 6.2 and SLES 11 SP2, combined in one book
  - NFS-exported files are stored in /var/nfs/ rather than /nfs/ in keeping with Linux FHS
  - Use of both layer 2 and layer 3 virtual switches
  - VSWITCH authorization granted through COMMAND statements in user directory profile
  - Section on relabelling z/VM system volumes removed
  - New chapter (17) on Live Guest Relocation (LGR) between SSI members
  - New chapter (18) on how to install and configure z/VM's DirMaint and SMAPI
  - New chapter (21) on how to install and configure xCAT
  - New section (19.4) on how to install and configure sysstat on Linux
  - Title is buzzword compliant :))

Changes in the July 17, 2012 book

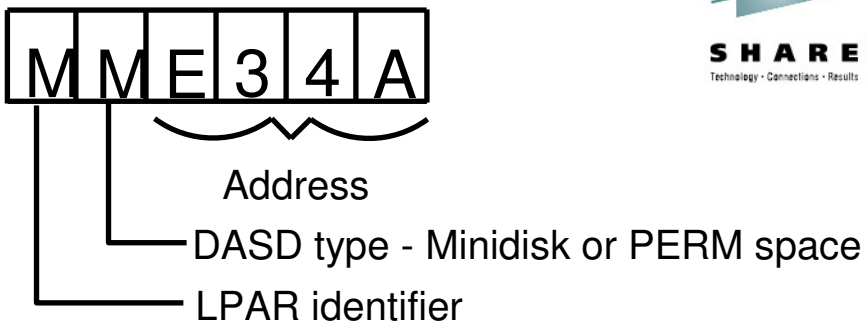
z/VM and Linux on IBM System z: The **Virtualization** Cookbook for z/VM 6.2 RHEL 6.2 and SLES 11 SP2 has many new sections:

- Title prefix is back.
- Steps for installing RACF into an z/VM 6.2 SSI cluster have been added.
  - This configuration describes adding the UseRACF=yes setting to DirMaint.
- z/VM development now recommends the use of layer 2 virtual switches (VSWITCH) exclusively.
- How to attach z/VM TCP/IP stack to HA virtual switch.
- MAINT's slightly modified PROFILE XEDIT is now copied to the MAINT 19E disk so that it need not be copied to many virtual machines 191 disk.
- Service section updated for z/VM 6.2 (now that the first RSU is available).
- An update to the CPFORMAT EXEC code has been made available. In the January 2012 version of the code, while in a non-SSI environment, OWNER data was still being written to CP-owned volumes. That issue has been corrected.

Introduction - Planning - bill of materials

- Hardware
  - System z LPARs (2 or 4 for SSI)
    - IFLs
    - Memory (aka *storage*)
    - DASD (aka *storage* :))
    - Two OSA cards for HA VSWITCH (One is OK)
  - Temporary Distributed server
- Software
  - z/VM 6.2
  - Linux
    - SLES-11 SP2
    - RHEL 6.2
  - Code associated with book: http://www.vm.ibm.com/devpages/mikemac/CKB-VM62.tgz
- Networking resources
  - TCP/IP address for z/VM
  - One TCP/IP address for each Linux
  - DNS names

Introduction - Planning (cont'd)



- 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
    - z/VM resources
    - Linux resources
    - z/VM DASD
    - Linux virtual machines

Introduction - Configure a desktop machine

- SSH client
  - PuTTY is described
    - Set SSH protocol to "2 only"
    - Add rows, columns, scrollback buffer
    - Save sessions
- VNC client
  - Recommended for install of Linux, some software
  - 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

Introduction - Configure a PC server

- Installing Linux on zSeries is a chicken and egg problem
- Recommendation: install Linux on an Intel box as a temporary NFS server:
  - Install Linux onto a PC
  - Copy files associated with this book to this NFS server
  - Untar to /var/nfs/CKB-VM62/
  - Set up an install directory under /var/nfs/<distro>/
  - Configure the NFS server to export these two directories

Installing and configuring z/VM

- Obtain z/VM through electronic download
- Configure an FTP server for z/VM installation
- Install z/VM from DVD or FTP server
- Customize TCPIP - z/VM stack, FTP server
- Customize SYSTEM CONFIG
  - Define VSWITCHes, other configuration
- Add volumes for paging and minidisks
  - CPFORMAT EXEC is included
- 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
- z/VM security issues

Obtain z/VM through Electronic Download

- Go to the z/VM service page:
  - http://www.vm.ibm.com/service/

- Click on the link **IBM Shopz** in the section *IBM Support Portals*
  - Sign in by clicking on the link *Sign in for registered users* in the upper right
  - Click on the link **create new software orders**
  - On *Step 1*, click on the radio button **z/VM Products** and choose **VM SDO version 6** in the dropdown menu to the right. Click Continue.
  - On *Step 2*, select a hardware system on which you plan to run z/VM
  - On *Step 3*, first filter, select **VM - VM Base Product**, second filter, select **Show all products** then click **Show catalog**
  - Select **z/VM V6 3390 System DDR** and click **Continue**
  - On *Step 4*, verify the order and click **Continue**
  - On *Step 5*, verify the entitlements and click **Continue**
  - On *Step 6*, for the *Preferred media*, select **Internet** and click **Continue**
  - On *Step 7*, review and click **Submit**

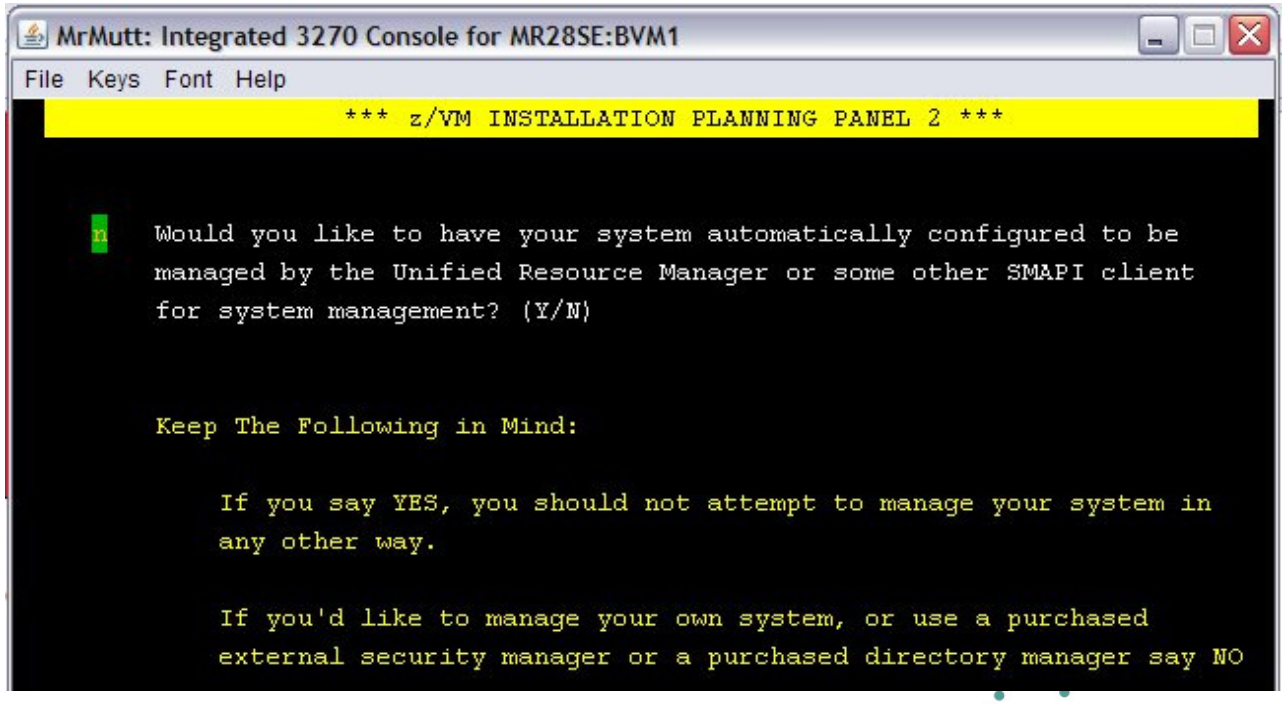
Configure an FTP server for z/VM installation

- Prepare the z/VM product install files
- Install the FTP server
- Configure the FTP server
  - Anonymous or not?
- Test the anonymous FTP server
- Aside: interesting fact:

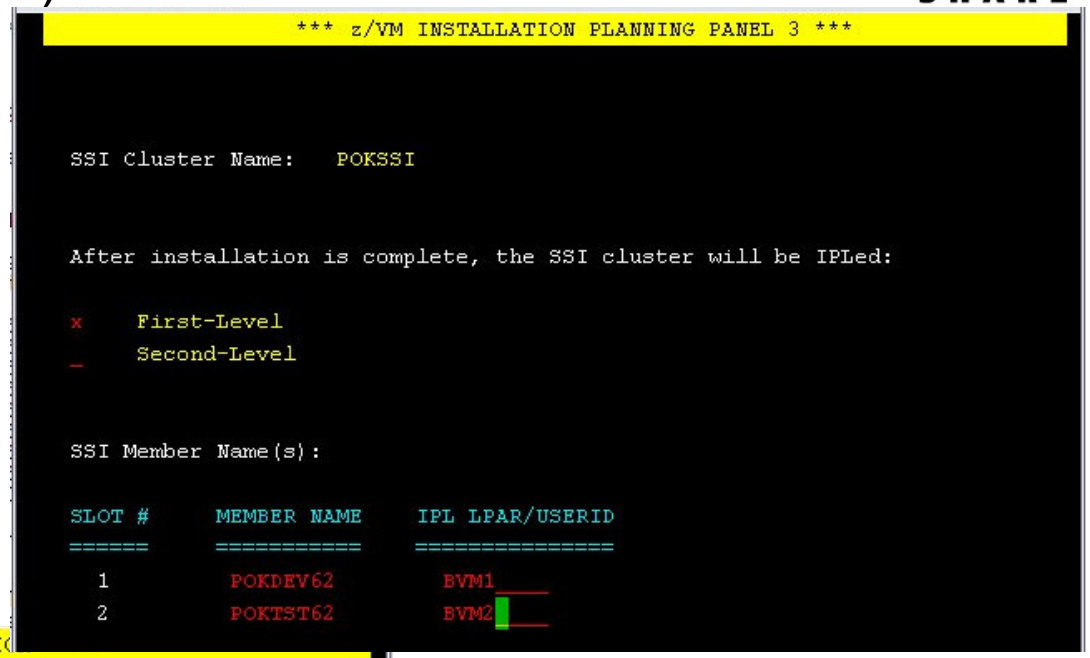
```
gpok240:/nfs # du -sh sles11sp2 rhel6.2 zvm62
13G sles11sp2
5.3G rhel6.2
4.1G zvm62
```

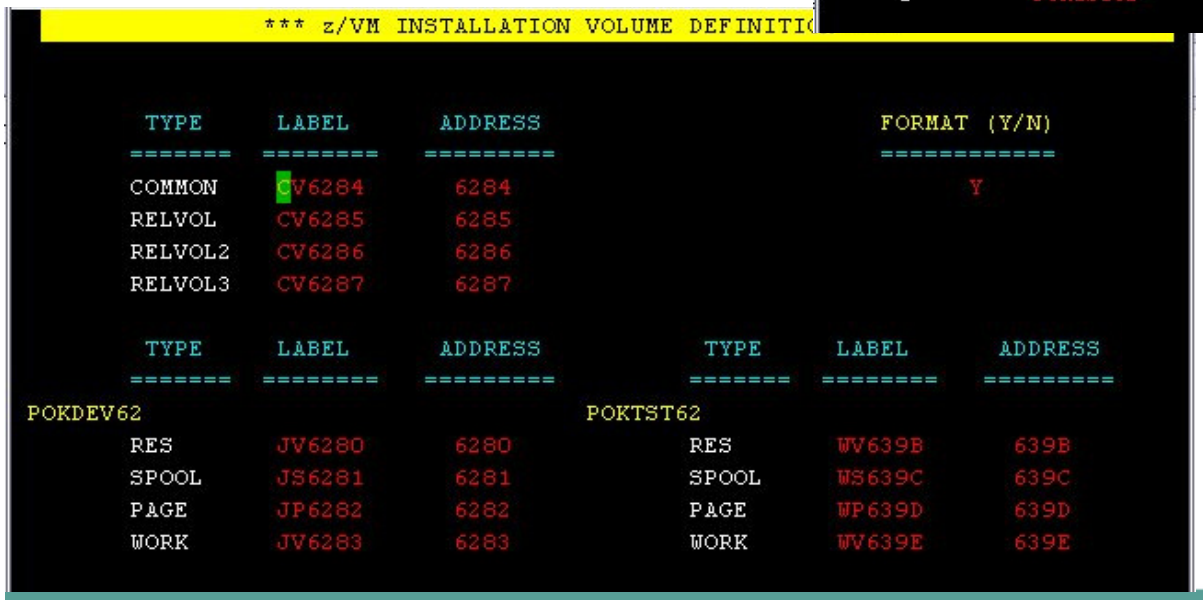
Install z/VM from DVD or FTP server

- Start the z/VM install
  - Important screens (below and next chart)
- Copy a vanilla z/VM system to DASD
- IPL the first SSI member
  - New IPL Parms:
  - ==> **q iplparms**
  - FN=SYSTEM FT=CONFIG PDNUM=1 PDVOL=D964
- IPL remaining SSI members
- Verify the installation
- Configure TCP/IP

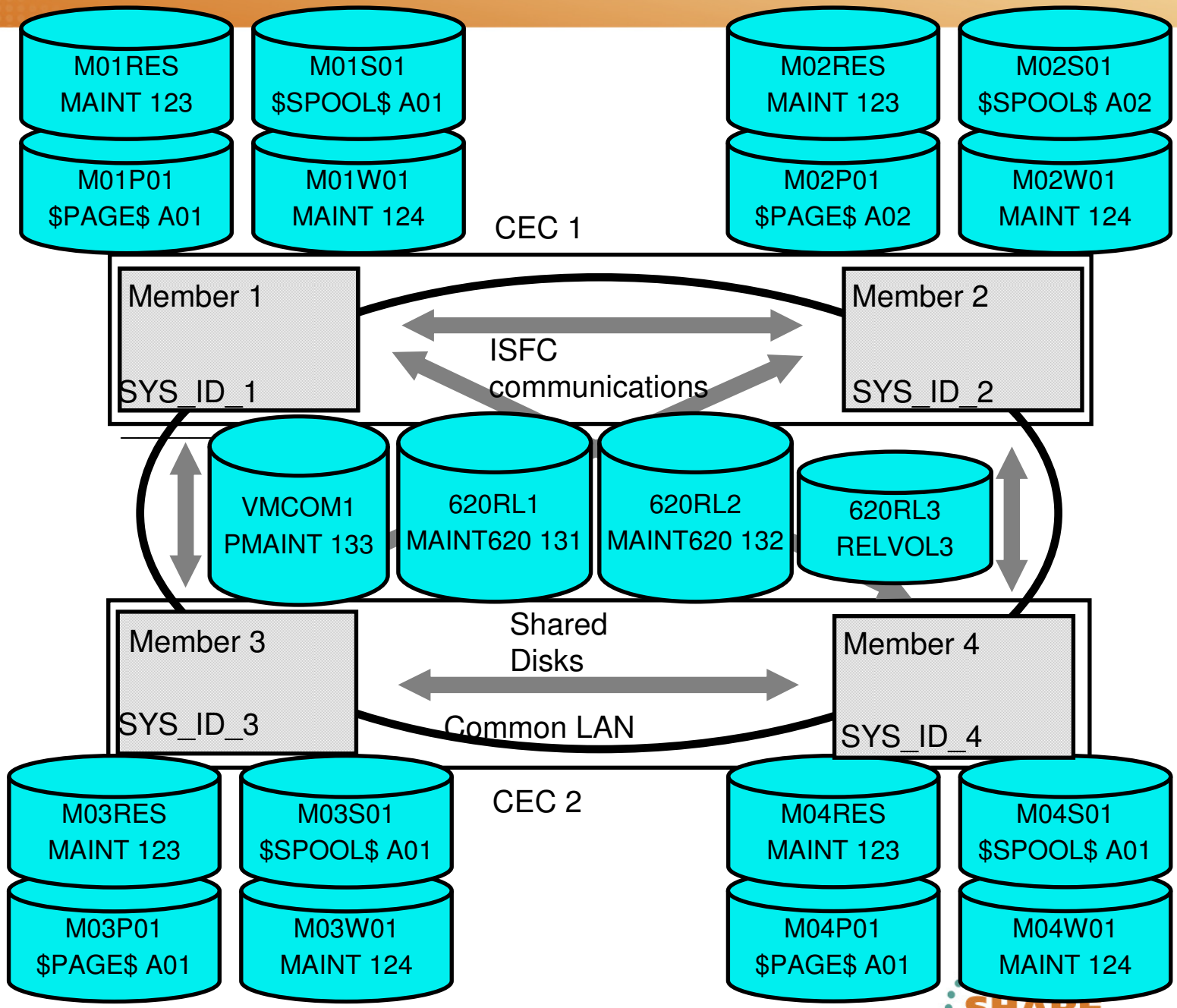


z/VM install screens (cont'd)

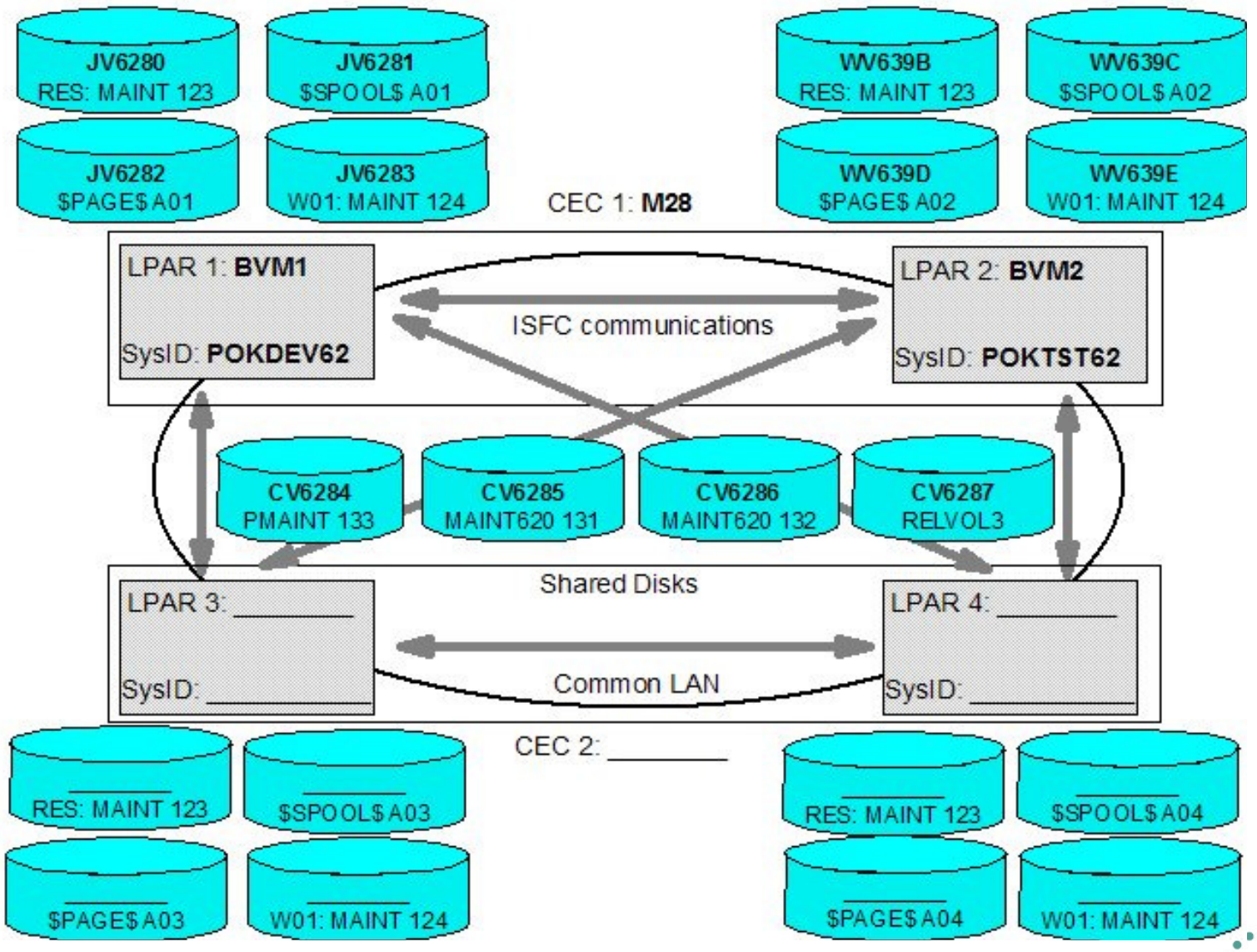




z/VM 6.2 SSI block diagram



SSI block diagram - values used in book



Customize z/VM TCP/IP stack and FTP server

- Recommend IPWIZARD for TCPIP configuration
  - Run once for each SSI member
  - Configure XEDIT profile on TCPMAINT
- Recommend turning on z/VM FTP server
  - Run once for each SSI member
- NEW: Attach the z/VM TCP/IP stack to the HA VSWITCH
  - Comment out :attach. Line in the SYSTEM DTCPARMS
  - Modify PROFILE TCPIP: OSA rdev ➔ 0600 vdev
  - Grant TCPIP access to VSW1 in the user directory

Customize SYSTEM CONFIG file

- Recommendations
  - Increase retrieve key capacity - from 20 to 99
  - Allow VDISKs to be created for swap spaces
    - Using SWAPGEN EXEC is common to create in-memory Linux swap spaces
  - Turn off the Disconnect Timeout feature
    - So Linux virtual machines are not forced off by SYSTEM
  - Define layer 2 and 3 virtual switches
    - Layer 2 is **now recommended**
  - Set up "Equivalency IDs" - new for z/VM 6.2

```
/* Add EQID statements for OSA addresses and unique MAC IDs */
POKDEV62: begin
  rdev 4200-420f eqid osaset1 type osa
  rdev 4300-430f eqid osaset1 type osa
  vmlan macprefix 02000b
POKDEV62: end
POKTST62: begin
  rdev 4200-420f eqid osaset1 type osa
  rdev 4300-430f eqid osaset1 type osa
  vmlan macprefix 02000c
POKTST62: end
```

CPFORMAT EXEC

```
==> cpformat
Synopsis:

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

Syntax is:
                 <---------------<
   >>--CPFORMAT--.-vdev--------.--AS---.-PERM-.---------><
                 '-vdev1-vdev2-'       '-PAGE-'
                                       '-SPOL-'
                                       '-TEMP-'
Example:
==> att <a775-a779> *
A775-A779 ATTACHED TO MAINT
==> cpformat <a775-a779> as page
...

New:  Owner information is added to CP-owned devices
```

Add volumes for paging and minidisks

- Copy the CPFORMAT EXEC
- Format volumes for page space
  - Use the CPFORMAT EXEC with "**for page**"
- Format DASD for minidisks
  - Use the CPFORMAT EXEC with "**for perm**"
- Update the SYSTEM CONFIG file. e.g.:

```
POKDEV62: BEGIN
  CP_Owned Slot 251 JP628A
  CP_Owned Slot 252 JP6288
  CP_Owned Slot 253 JP6233
  CP_Owned Slot 254 JP6232
  CP_Owned Slot 255 JV6282
POKDEV62: END
POKTST62: BEGIN
  CP_Owned Slot 251 WP633E
  CP_Owned Slot 252 WP633C
  CP_Owned Slot 253 WP633B
  CP_Owned Slot 254 WP628B
  CP_Owned Slot 255 WV639D
POKTST62: END
...
User_Volume_List CV6285 CV6286 CV6287
User_Volume_Include JM6*
```

Create LNXMAINT for common CMS files

- Define virtual machine
- Customize virtual machine
- Copy files
  - 191 disk: `PROFILE EXEC, PROFILE XEDIT`
  - 192 disk: Common Linux files

```
PROFILE EXEC
PROFILE XEDIT
SAMPLE CONF-RH6
SAMPLE PARM-S11
SWAPGEN EXEC
RHEL62 EXEC
SAMPLE PARM-RH6
SLES11S2 EXEC
<Linux> RAMDISK
<Linux> KERNEL
```

Customizing z/VM startup and shutdown

- Add a minidisk link to AUTOLOG1 user directory entry
- Call a startup EXEC common to all SSI members - New – this has been removed.

```
/* Common code to be run at SSI IPL time */
"CP XAUTOLOG TCPIP" /* Autolog TCPIP */
"CP SET MDC STOR 0M 128M" /* Limit minidisk cache in CSTOR */
"CP SET MDC XSTORE 0M 0M" /* Disable minidisk cache in XSTOR */
"CP SET SIGNAL SHUTDOWN 600" /* Allow guests 10 min to shut down
*/
```

- Start Linux virtual machines on appropriate SSI members

```
/* Start Linux systems on SSI member 1 */
"CP XAUTOLOG LINUX01"
"CP XAUTOLOG LINUX02"
```

- Test a SHUTDOWN REIPL

SSISHUTD and SSICMD EXECs

```
==> ssishutd help
Synopsis:
  SHUTDOWN or SHUTDOWN REIPL an SSI cluster

Syntax is:
   >>--SSISHUTD-----.---------.----------><
                    '--REIPL--'

==> ssicmd
Synopsis:
SSICMD cmd

cmd is a command to be issued on each of the members
  in the SSI cluster using the AT command.

Example:
==> ssicmd q proc
POKDEV62:
PROCESSOR 00 MASTER CP
PROCESSOR 01 ALTERNATE CP

POKTST62:
PROCESSOR 00 MASTER CP
PROCESSOR 01 ALTERNATE CP
```

z/VM security issues

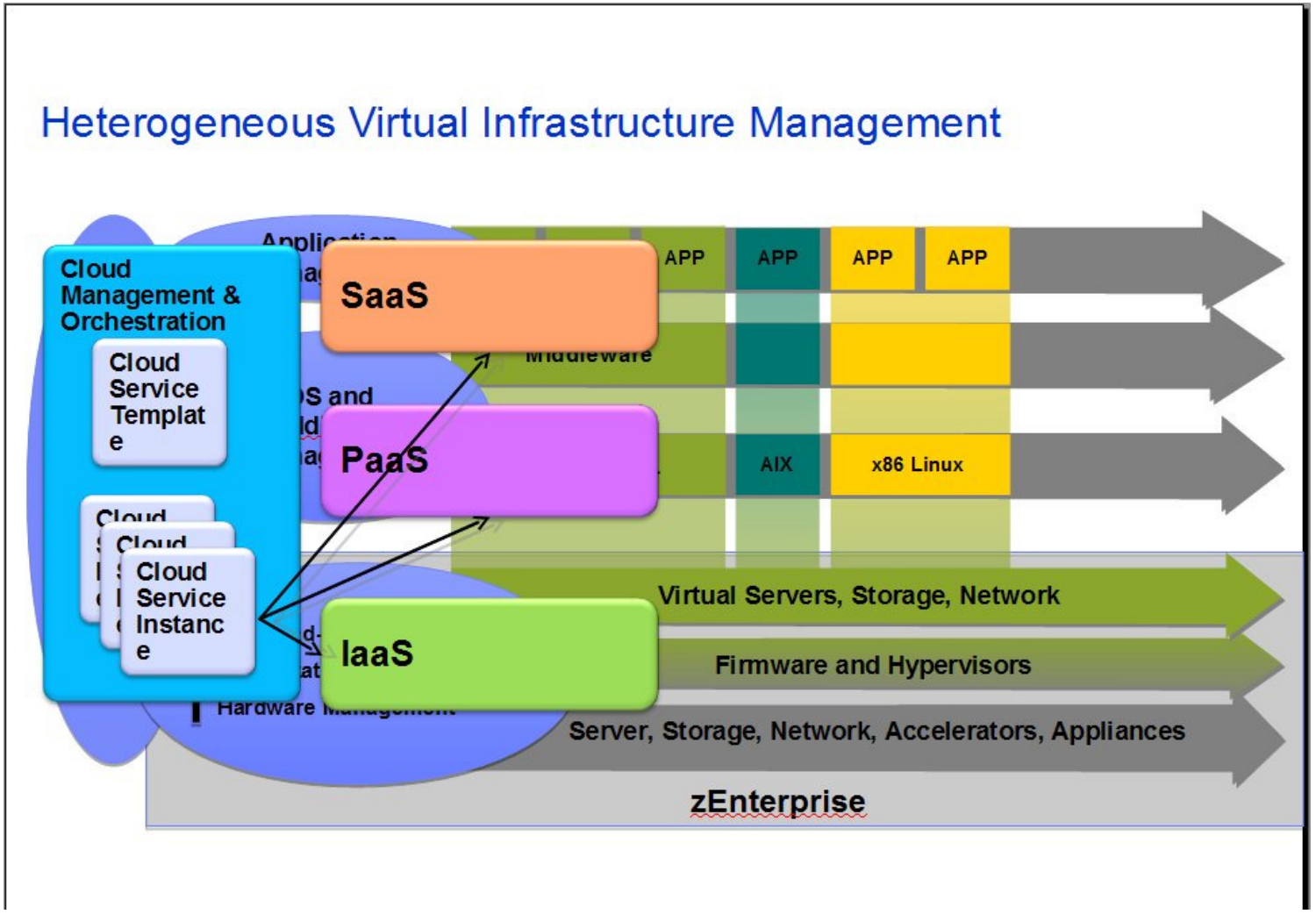
- Change passwords in USER DIRECT
- Use a z/VM Security product?
  - IBM RACF
  - CA VM:Secure
- The paper *z/VM Security and Integrity*
  - http://www.vm.ibm.com/library/zvmsecint.pdf

Servicing z/VM

- Apply a Programming Temporary Fix (PTF)
  - Get service from Internet
  - Receive, apply and build
  - Put into production
- Apply a Recommended Service Upgrade (RSU)
  - New: RSU6202 is now available and documented
- Determining z/VM's service level

Cloud - <X>aaS

- Software as a Service (SaaS)
- Platform as a Service (PaaS)
- Infrastructure as a Service (IaaS) - aka "container"



Virtualization Terminology

- User ID
- Virtual machine
- Guest
- Container

z/VM Live Guest Relocation (LGR)

- LGR considerations
  - USERs are relocatable, not IDENTITYs
  - Memory size (central, expanded)
  - Link and resource contention
  - Add `OPTION CHPIDV ONE` to the Linux PROFILE in user directory
  - Linux must not have CMS disks at relocate time
    - Disks can be detached at Linux boot time
    - Added to /etc/rc.d/rc.local:

```
...
chshut halt vmcmd logoff
chshut poff vmcmd logoff
modprobe vmcp
vmcp det 190
vmcp det 191
vmcp det 19d
vmcp det 19e
rmmod vmcp
```

- Relocate a Linux system

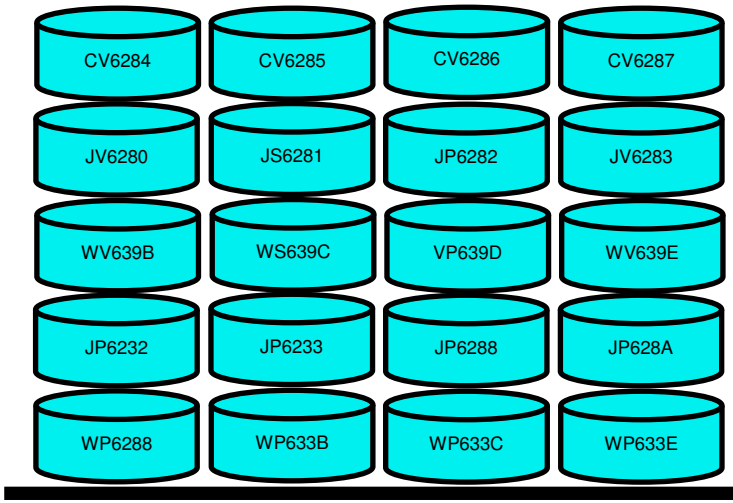
```
==> vmrelocate test <user ID> <target system ID>
==> vmrelocate move <user ID> <target system ID>
```

  - Demo?

Configure DirMaint and SMAPI

- Configure DirMaint
  - Enable DirMaint
  - Tailor DirMaint
  - Customize the EXTENT CONTROL file
  - Start DirMaint
  - Test DirMaint
  - Test DirMaint at IPL time
- Configure SMAPI
  - Set up basic SMAPI configuration
  - Turn off ensembles
  - Start SMAPI at IPL time
  - Test SMAPI
- Some common DirMaint tasks
  - Update a user directory entry
  - Edit the EXTENT CONTROL file
  - Get a copy of the user directory
  - Add an IDENTITY
- New: Section on RACF

DASD view of the system



Role: *z/VM sysadmin*

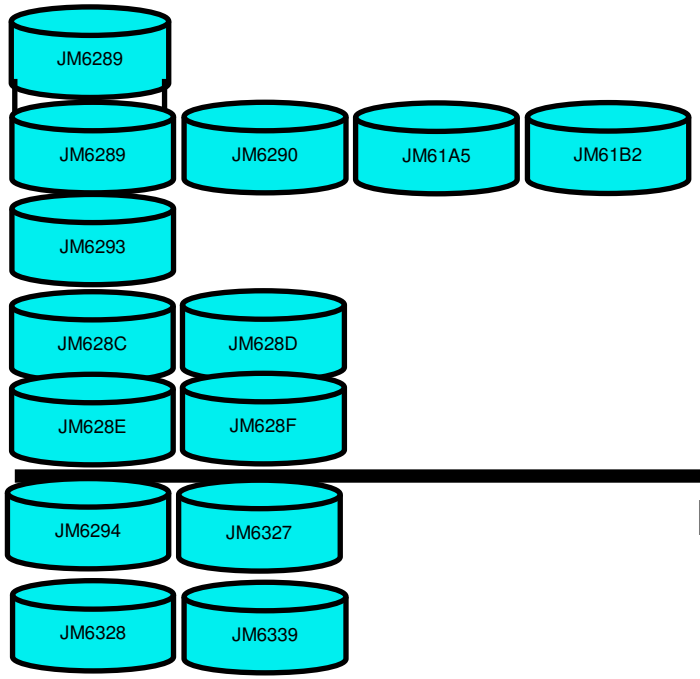
Common volumes (4 3390-3s)

Member 1 volumes (4 3390-3s)

Member 2 volumes (4 3390-3s)

Member 1 page space (4 3390-3s)

Member 2 page space (4 3390-3s)



Role: *Linux sysadmin*

LNXMAINT (320 cyl)

Member 1 LNXADMIN (2 3390-3s, 2 3390-9s)

Member 2 LNXADMIN (1 3390-3s)

RH62GOLD (2 3390-3s)

S112GOLD (2 3390-3s)

LINUX153 (2 3390-3s)

Role: *Linux users*

LINUX157 (2 3390-3s)

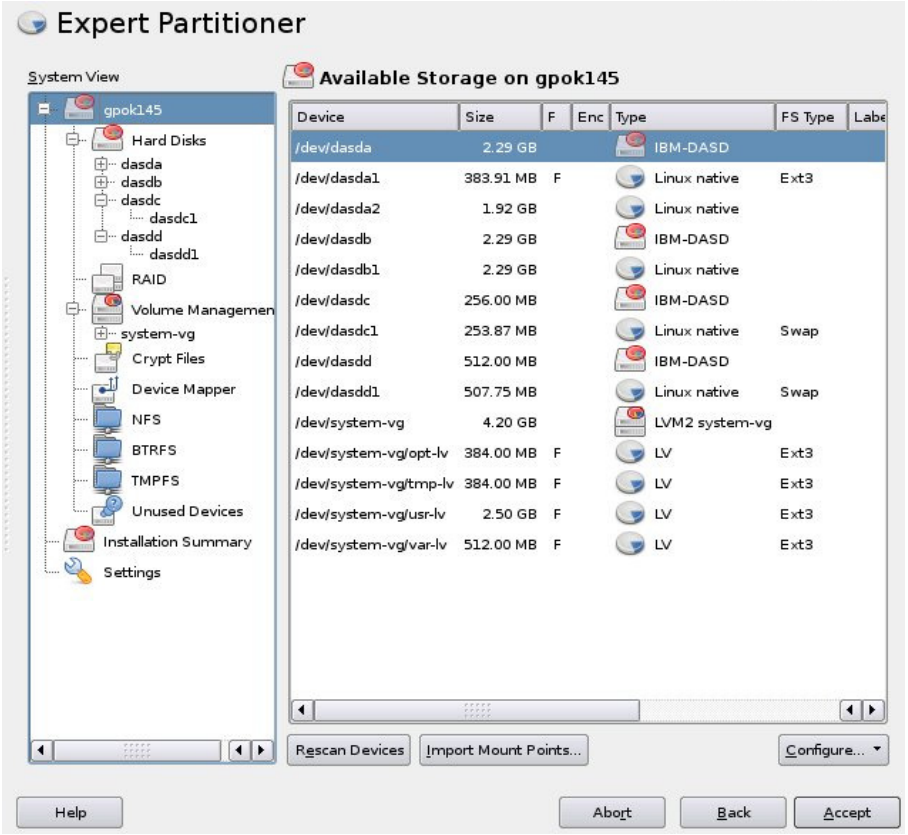
Install and configure RHEL 6.2 on LNXADMIN

- Install the Linux Administration system (7.1)
  - Create the IDENTITY LNXADMIN
  - Set LNXADMIN to start at IPL time
  - Prepare the RHEL 6.2 bootstrap files
  - Install RHEL 6.2 Linux
  - Boot the new system from disk
- Configure the Linux administration system (7.2)
  - Copy RHEL 6.2 install tree/other files from PC to LNXADMIN
  - Configure yum
  - Turn off unneeded services
  - Configure the VNC server
  - Set system to halt on SIGNAL SHUTDOWN
  - Turn on NFS server
  - Configure SSH keys
  - Change order of swap disks
  - Insert vmcp module
  - Reboot/verify changes

Install and configure the RHEL 6.2 golden image

- Install the golden image
  - Create the RH62GOLD virtual machine
  - Prepare the RH62GOLD parameter files
  - Install RHEL 6.2 on the golden image
    - File system layout with LVMs
  - Verify the installation

- Configure the golden image
  - Configure automount of the install tree
  - Configure yum for online updates
  - Turn off unneeded services
  - Configure the VNC server
  - System to halt on SIGNAL SHUTDOWN
  - Configure SSH keys and boot time settings
  - Change the order of the swap disks
  - Reboot system and verify changes



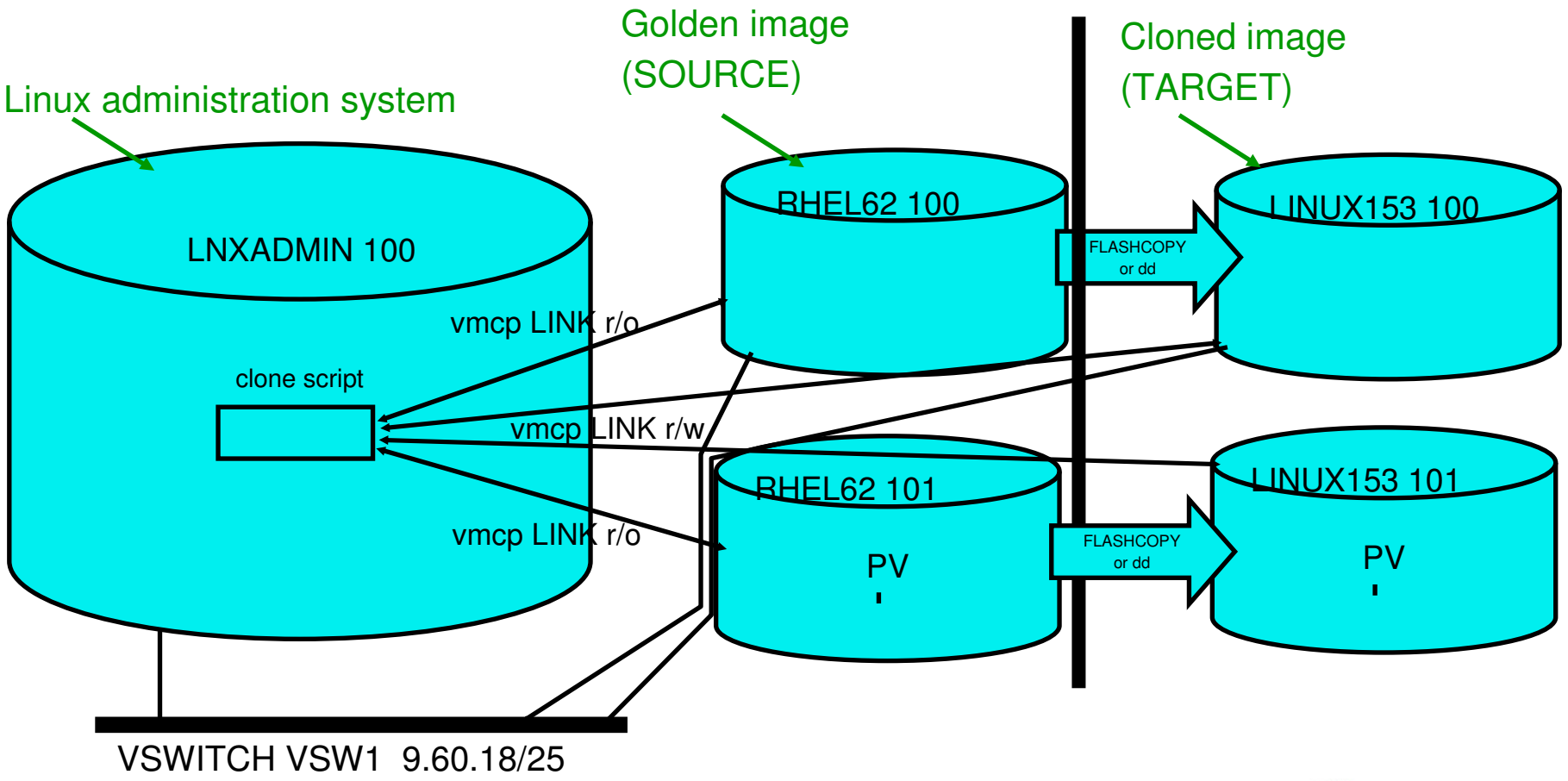
Mount point§	Logical volume name§	Size§
/usr/§	**usr-lv§**	2.5 GB§
/var/§	**var-lv§**	512 MB§
/opt/§	**opt-lv§**	384 MB§
/tmp/§	**tmp-lv§**	384 MB§

Configure RHEL 6.2 for cloning

- Define two new virtual machines
- Clone a virtual server manually
- Clone a virtual server automatically
- Review system status

Cloning Linux

- Cloning block diagram:

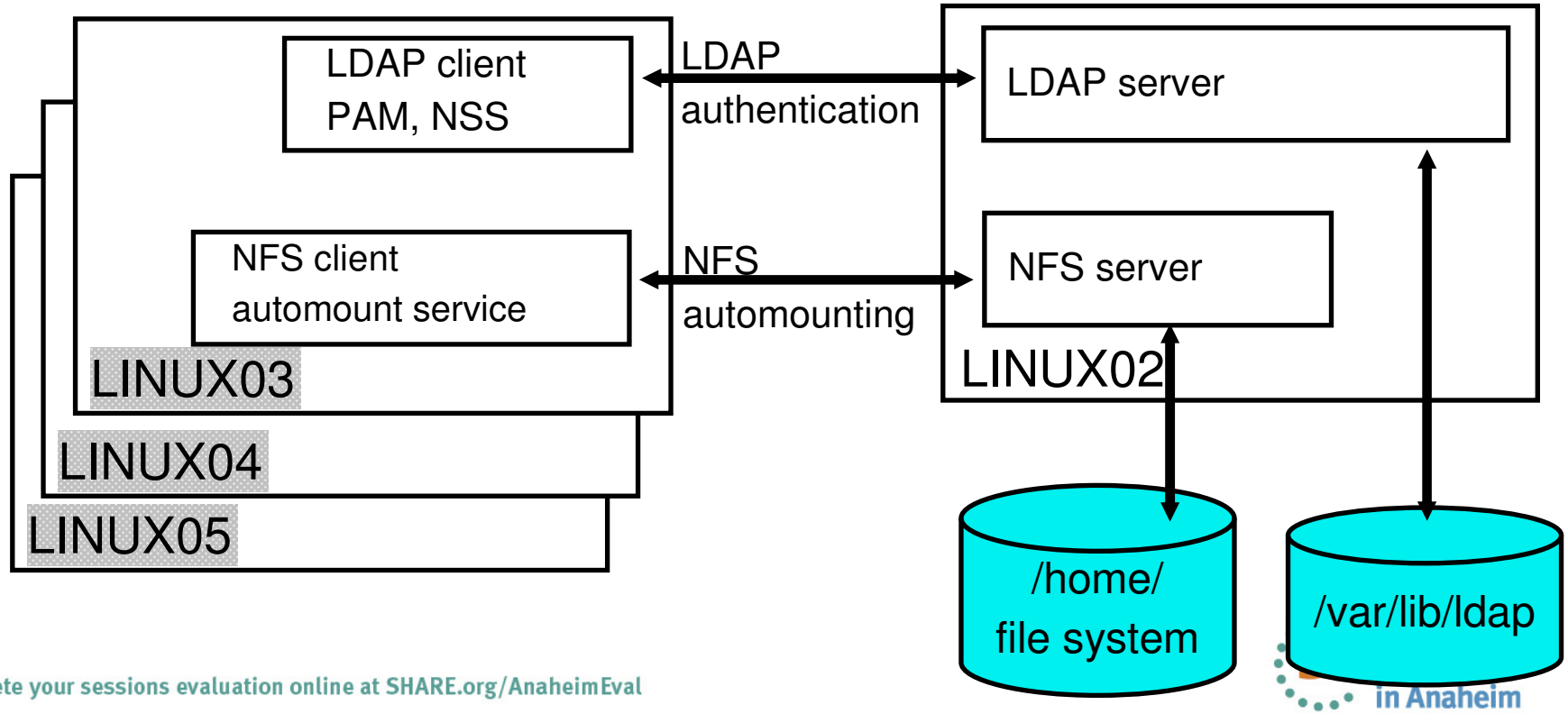


Install Linux with Kickstart

- Configure the Linux Administration system for kickstart
- Configure a virtual machine for kickstart
- "Kickstart" RHEL 6.2 to the virtual machine

Create RHEL 6.2 appliances

- Create a Web Server appliance
- Create an application development appliance
- Create an LDAP appliance
- Create a file and print server appliance
- Also: "travelling /home" (details in SLES 10 SP2 book)
  - Brings together LDAP, LVM, PAM/NSS, Automount and NFS



Service Linux with the Red Hat Network

- Register your system with RHN
- Install and update packages with yum
- Manage your systems with RHN

Install SLES 11 SP2 on LNXADMIN

- Review the identity LNXADMIN
- Prepare the SLES 11 SP2 bootstrap files
- Install SLES 11 SP2 on to LNXADMIN
- Configure the Linux administration system
  - Copy files to the RHEL Linux administration system (large LV)
  - Reset install location
  - Turn off unneeded services
  - Apply service
  - Install the cmsfs package
  - Enable vmcp
  - Set system to halt on SIGNAL SHUTDOWN
  - Modify zipl.conf
  - Reboot and verify changes

Install the SLES 11 SP2 golden image

- Create the S112GOLD virtual machine
- Create the S112GOLD parameter file
- Install the SLES 11 SP2 golden image
  - Logical volumes for flexibility:
- Configure SLES 11 SP2 golden image
  - Configure the VNC server
  - Prepare for YaST Online Update
  - Turn off unneeded services
  - Apply service with Online Update
  - Configure /etc/inittab
  - Configure SSH keys
  - Modify zipl.conf
  - Cleanup temporary files
  - Reboot and verify changes

Mount point	Logical volume name	Size
/usr/	usr-lv	2.5 GB
/var/	var-lv	512 MB
/opt/	opt-lv	384 MB
/tmp/	tmp-lv	384 MB

Clone SLES 11 SP2

- Clone a virtual server manually
- Clone a virtual server automatically

Create SLES 11 SP2 appliances

- Create a Web Server appliance
- Create an LDAP appliance
- Create a file and print server appliance
- Create an application development appliance

Monitor and tune z/VM and Linux

- Use basic z/VM commands
- The z/VM Performance Toolkit
  - Configure the z/VM Performance Toolkit
  - Configure Web Browser support
  - Configure PERFSVM
  - Start the z/VM Performance Toolkit
  - Use the z/VM Performance Toolkit
- Monitor Linux performance data from the kernel
- Monitor Linux with sysstat
- Suggested GOAL: Get to z/VM and Linux historical graphs quickly

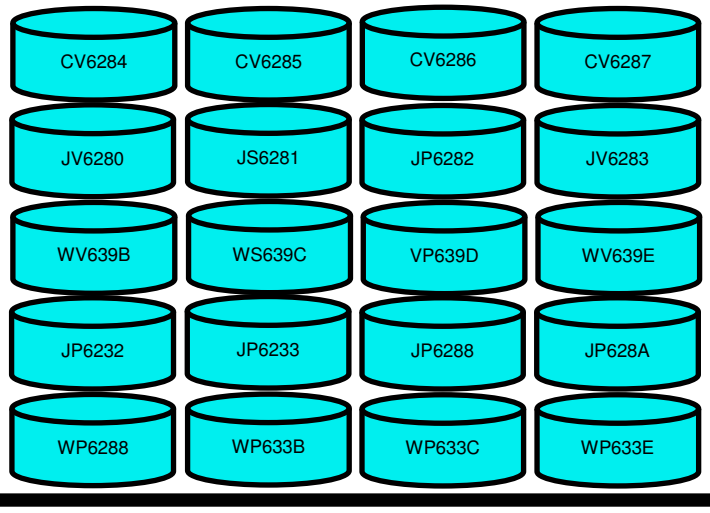
Miscellaneous Recipes

- Add disk space to virtual machines
- Add a logical volume
- Extend an existing logical volume
- Add SCSI/FCP disks
  - As emuldated devices (aka "EDEVs")
  - As real devices
- Rescue a Linux system
- Set up memory hot plugging
- Utilize the cpuplugd service
- Hardware cryptographic support for OpenSSH
- The X window system
- Centralizing home directories for LDAP users

xCAT

- Overview of xCAT
- Install the xCAT Management Node
  - Turn off SE Linux on RHEL 6.2
  - Download and unwind the xCAT Management Node install files
  - Create repositories for the xCAT code
  - Install the xCAT management node
- Install the xCAT User Interface
- Install the xCAT Hardware Control Point
  - Add a privilege class to LNXADMIN
  - Initialize the xCAT database
  - Define nodes
  - Configure networking servers
- xCAT tasks
  - Kickstart a RHEL 6.2 system
  - Clone a SLES 11 SP2 system
  - <hoped for more>

DASD view of the system



Role: *z/VM sysadmin*

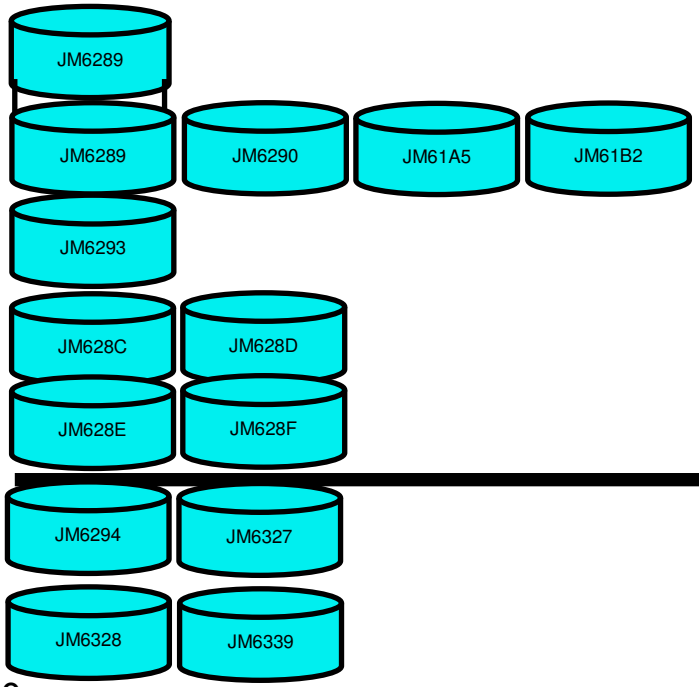
Common volumes (4 3390-3s)

Member 1 volumes (4 3390-3s)

Member 2 volumes (4 3390-3s)

Member 1 page space (4 3390-3s)

Member 2 page space (4 3390-3s)



Role: *Linux sysadmin*

LNXMAINT (320 cyl)

Member 1 LNXADMIN (2 3390-3s, 2 3390-9s)

Member 2 LNXADMIN (1 3390-3s)

RH62GOLD (2 3390-3s)

S112GOLD (2 3390-3s)

LINUX153 (2 3390-3s)

Role: *Linux users*

LINUX157 (2 3390-3s)

Resources

- All *Virtualization Cookbooks* and other papers:
  - http://www.vm.ibm.com/devpages/mikemac/
- *The* Linux for zSeries and S/390 portal
  - http://linuxvm.org/
- The linux-390 list server
  - http://www2.marist.edu/htbin/wlvindex?linux-390
- Linux for zSeries and S/390 developerWorks®
  - http://awlinux1.alphaworks.ibm.com/developerworks/linux390/index.shtml
- Red Hat Enterprise Linux evaluation
  - http://www.redhat.com/rhel/server/mainframe/
- SUSE LINUX Enterprise Server evaluation
  - http://www.novell.com/products/linuxenterpriseserver/eval.html
- z/VM publications
  - http://www.vm.ibm.com/pubs/
- z/VM performance tips
  - http://www.vm.ibm.com/perf/tips/

Session Evaluations

- The Cloud Computing Cookbook
- Session 11938
- www.SHARE.org/AnaheimEval

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