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

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Thursday February 15th, 9:30 AM
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?
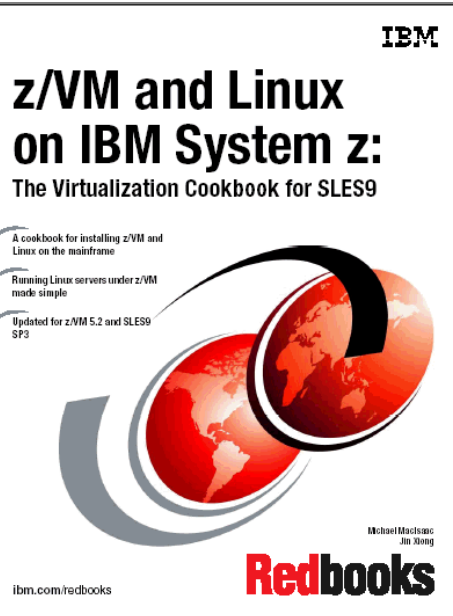 - ► Something you are hoping to get out of this talk?

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Timeline: Redbooks and whitebooks

Announcing! => **6,7** *The Virtualization Cookbook(s) for RHEL 5 and SLES 10*, **2/07**

5 *The Virtualization Cookbook 2* published on linuxvm.org, **8/06**

2 *The Virtualization Cookbook* published on linuxvm.org, **2/06**

Project started: 11/04

2004	2005	2006	2007

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

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

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

z/VM and Linux on IBM System z:
The Virtualization Cookbook
A cookbook for installing and customizing z/VM 5.2 and Linux SLES9 on the mainframe
Michael MacIsaac
Jin Xiong

z/VM and Linux on IBM System z:
The Virtualization Cookbook for SLES9
A cookbook for installing z/VM and Linux on the mainframe
Running Linux servers under z/VM made simple
Updated for z/VM 5.2 and SLES9 SP3
Michael MacIsaac
Jin Xiong
Redbooks
ibm.com/redbooks

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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/

Block Diagram

LPAR 2: z/VM 5.2 on a z9

L P A R 1

L P A R n

| 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)

Planning (cont'd)

```
┌─┬─┬─┬─┬─┬─┐
│M│M│E│3│4│A│
└─┴─┴─┴─┴─┴─┘
```

Address — DASD type - Minidisk or PERM space — LPAR identifier

- 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:

                                       .-PAGE-.
   >>--CPFORMAT--.-rdev--------------.--AS---+-PERM-+--------->< 
                 | <---------------< |       '-SPOL-'
                 '-rdev1-rdev2------'
Example:
==> att <a775-a779> *
A775-A779 ATTACHED TO MAINT
==> cpformat <a775-a779> as page
...
```

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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

520RES	520W01	520W02	520SPL	520SPL
E340	E341	E342	E343	E344

z/VM system 1

520RES	520W01	520W02	520SPL	520SPL
F000	F001	F002	F003	F004
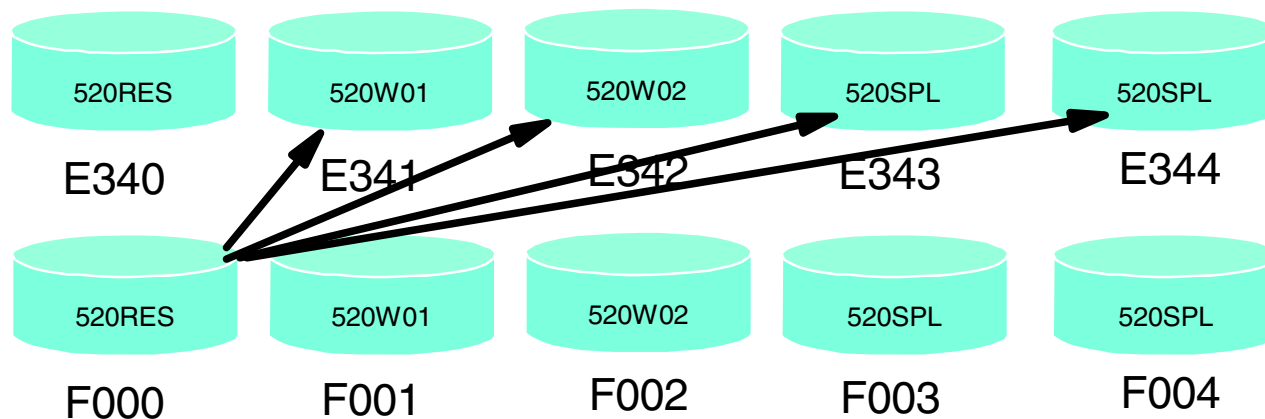
z/VM system 2

LPAR 1

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

VME346

LINUX volumes
(next)
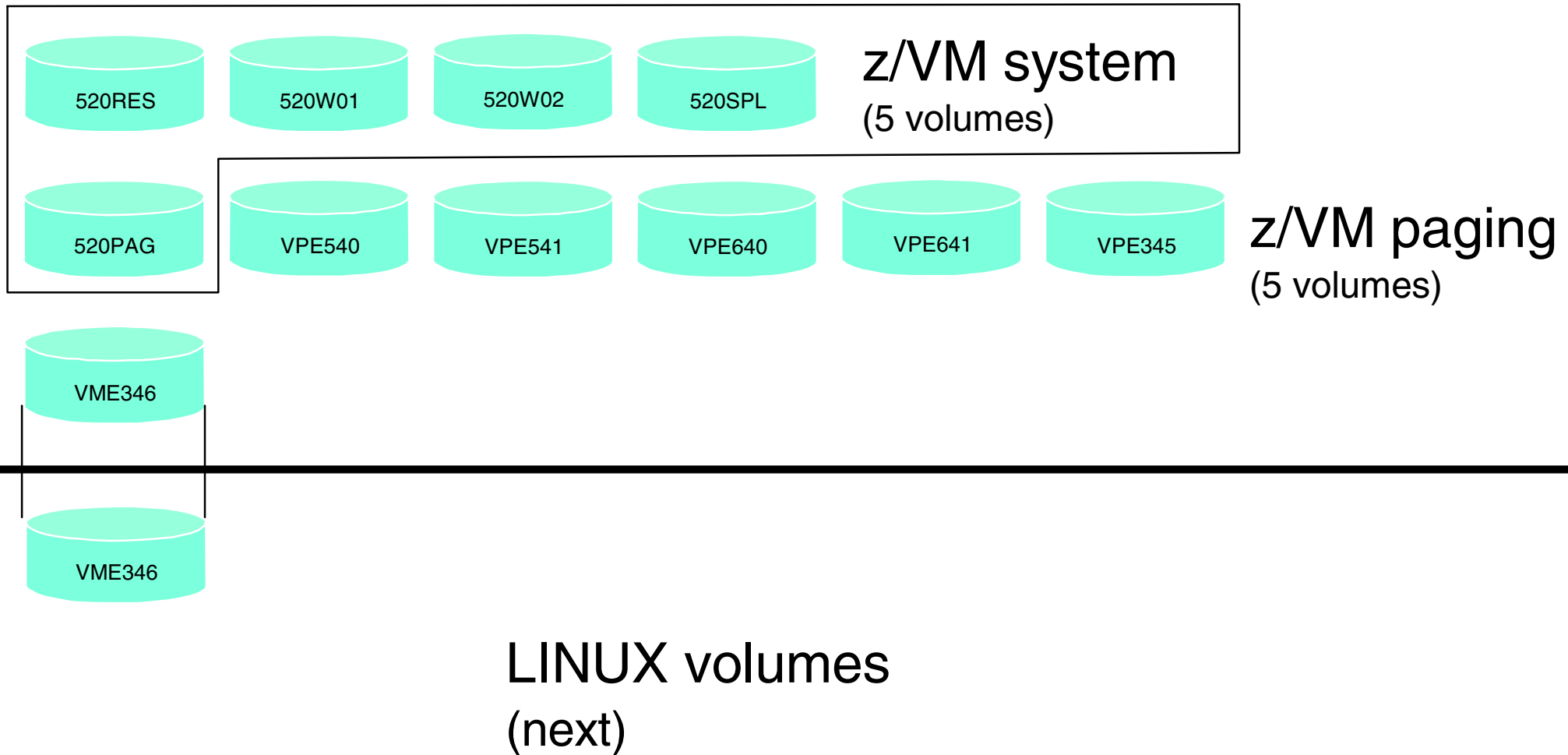
Configure a PC NFS server

- 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

Controller

Master image

Cloned image

SLES10 200

SLES10 100

LINUX01 100

/

usr/   var/   sbin/   ...   dev/

clone.sh

sles10master/

usr/   var/   sbin/   ...   dev/

FLASHCOPY
or dd

/

usr/   var/   sbin/   ...   dev/
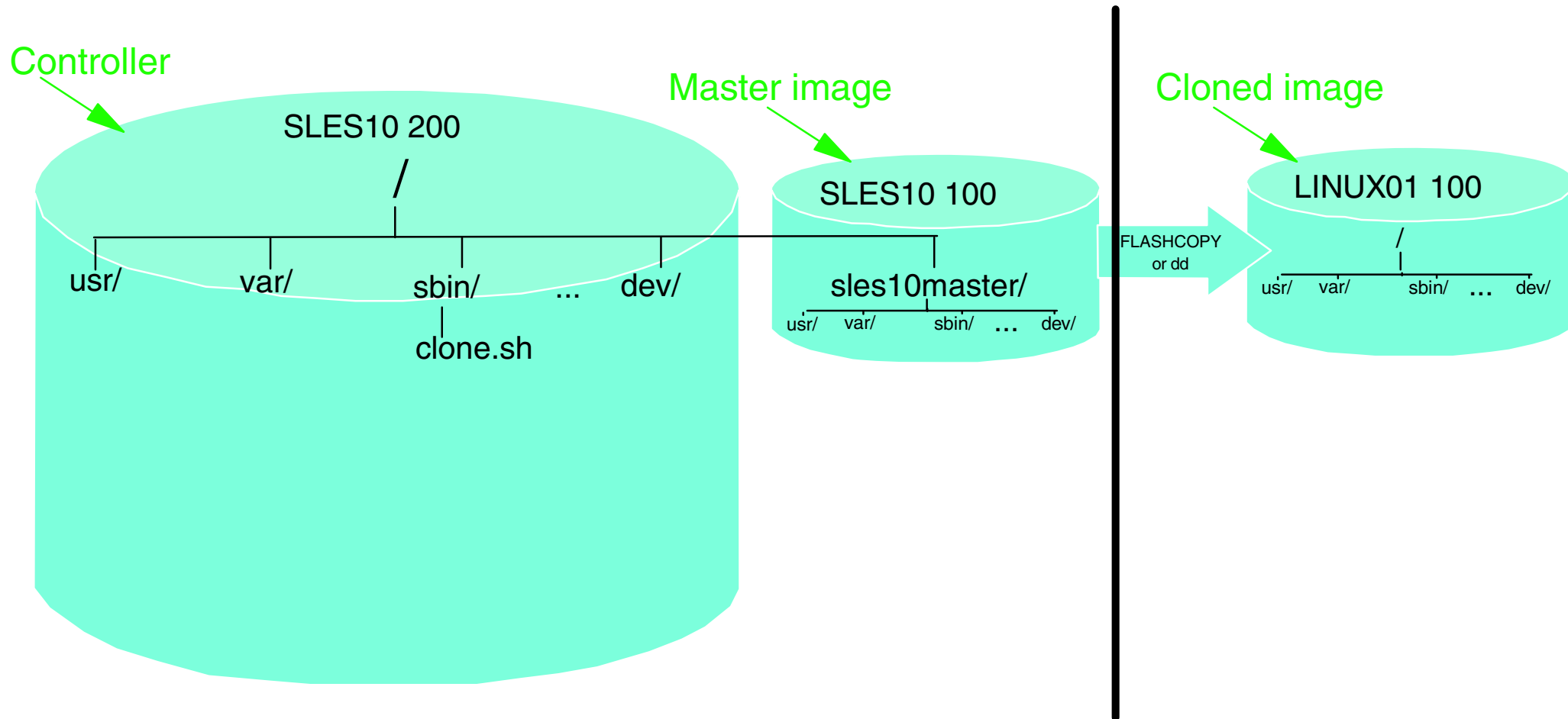
Installing and configuring Linux (cont'd)

- 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
(5 volumes)

520RES   520W01   520W02   520SPL

520PAG   VPE540   VPE541   VPE640   VPE641   VPE345

z/VM paging
(5 volumes)

VME346

LNXMAINT 191/192: common files (320 cyl)

z/VM sysadn

VME346   VME347   VME348   VME349   ...   VME34C

<main ID> (7 volumes)

Linux sysadmin

VME34D   LINUX01

Linux end users

VME542   VME543   VME544   ...   VME547

LINUX02-07 (6 volumes)
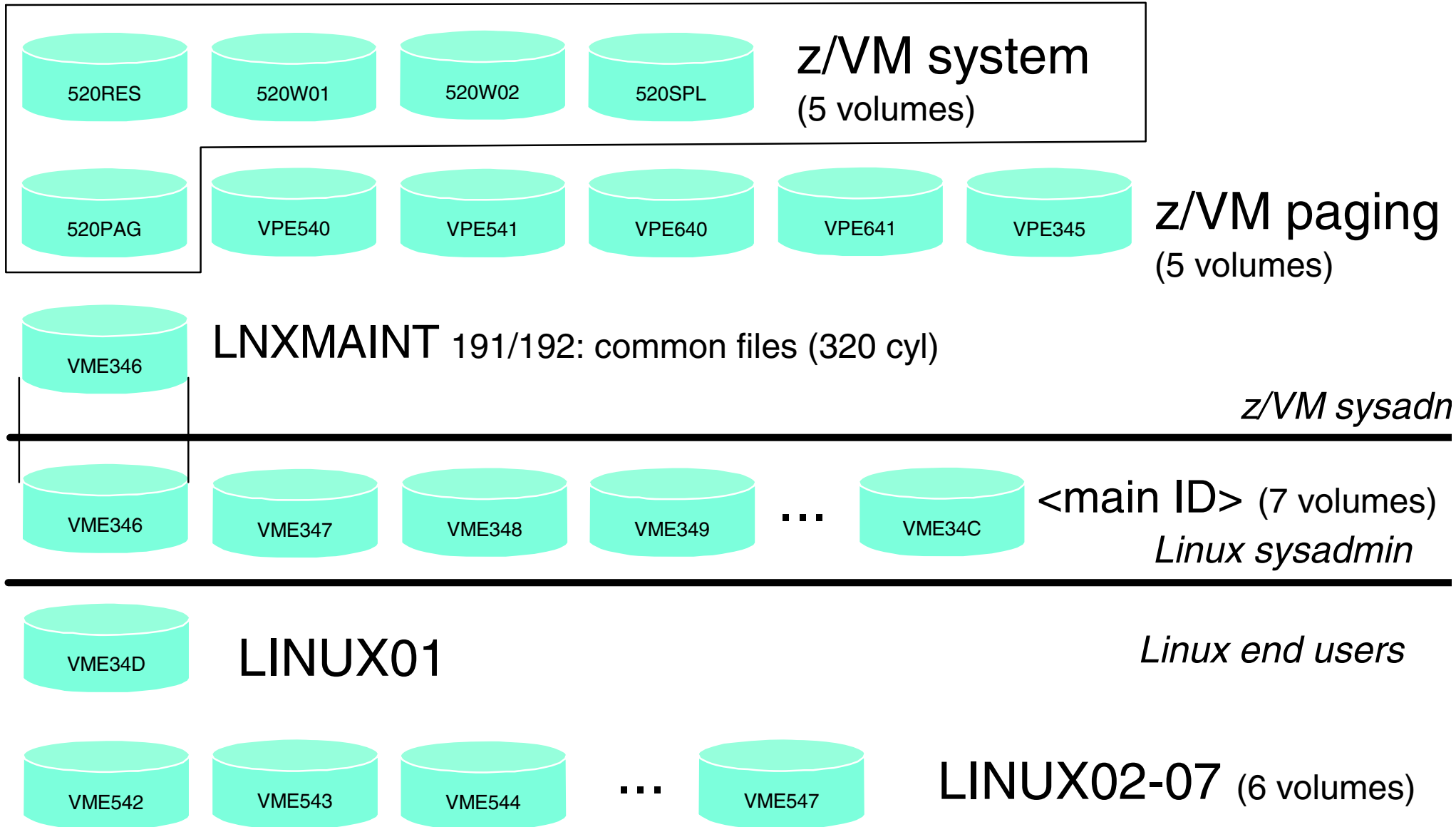
Miscellaneous Recipes

- 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

LDAP
authentication

LDAP server

NFS client
automount service

NFS
automounting

NFS server

LINUX03

LINUX04

LINUX05

LINUX02

/home/
file system

/var/lib/ldap
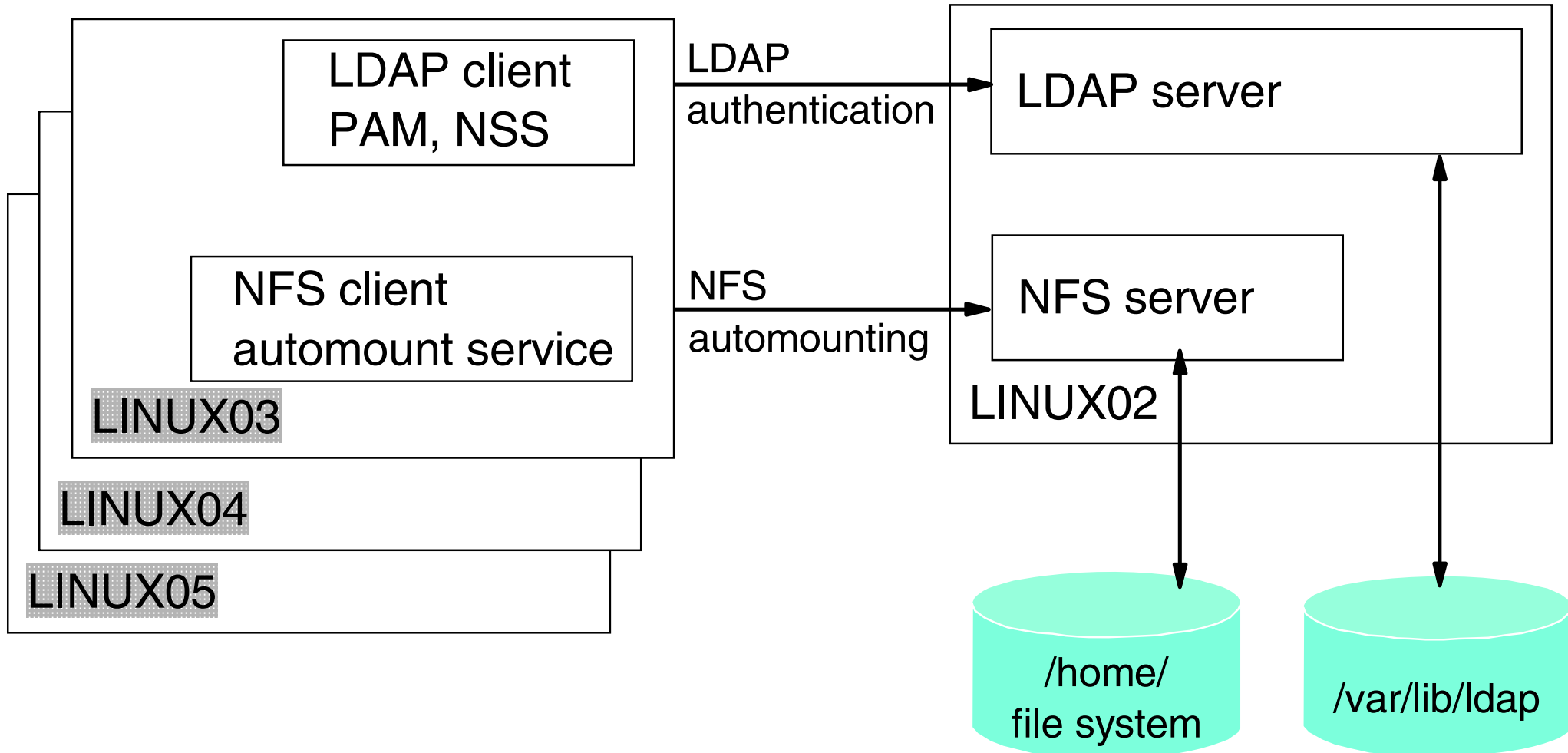
Monitoring z/VM and Linux

- 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

Monitoring z/VM and Linux (cont'd)

- Data About z/VM and Linux (DAZL)
  - ► Overall design:

Linux controller

Browser ↔ Apache Web server

JavaScript AJAX

cgi-bin/ scripts

z/VM CP

sudo vmcp

sudo ssh

Linux virtual servers

LINUX03
LINUX04
LINUX05

/

backup/   var/   sbin/   ...   dev/

linux/   vm/

/sbin/backupLinux.sh

/sbin/backupVM.sh

ssh, rsync

CP, cmsfs

MAINT 191, 2CC, CF1

TCPMAINT 198, 592

TCPMAINT 198, 592

z/VM minidisks
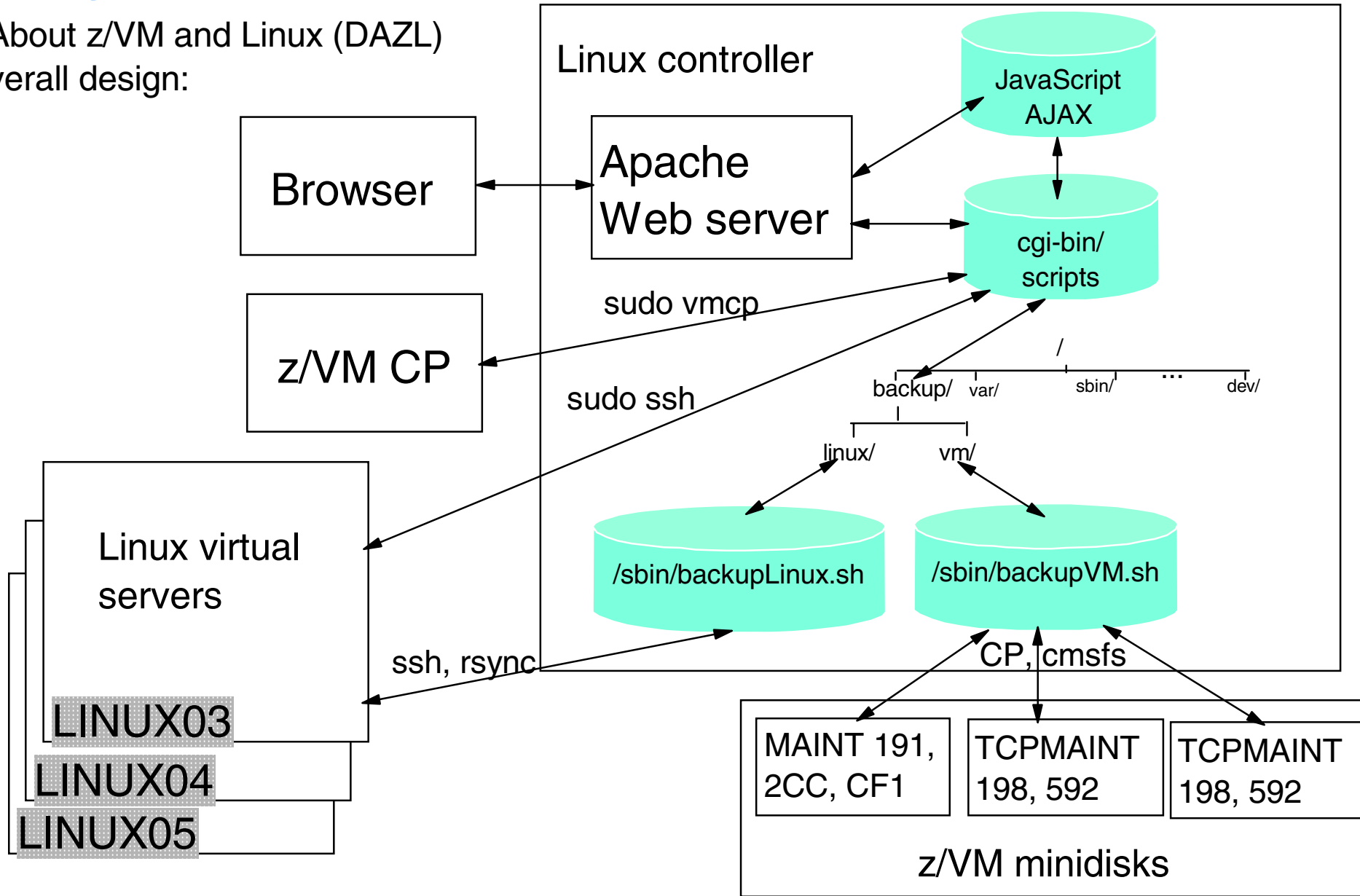
Monitoring z/VM and Linux (cont'd)

- DAZL Screen shots:

+1 page

+3

Monitoring z/VM and Linux (cont'd)

- DAZL Linux report:

Monitoring z/VM and Linux (cont'd)

- DAZL editing in place:

Monitoring z/VM and Linux (cont'd)

- DAZL z/VM report:

Live Demo

Resources

- Book *z/VM and Linux on System z: The Virtualization Cookbook for SLES 10*
  - ► http://linuxvm.org/present/virt-cookbook-S10.pdf
- Files associated with the SLES 10 book
  - ► ftp://linuxvm.org/present/virt-cookbook-S10.tgz
- Book *z/VM and Linux on System z: The Virtualization Cookbook for RHEL 5* (publish Feb 28?)
  - ► http://linuxvm.org/present/virt-cookbook-RH5.pdf
- Files associated with the RHEL 5 book (Feb 28?)
  - ► ftp://linuxvm.org/present/virt-cookbook-RH5.tgz
- *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
- SUSE LINUX Enterprise Server 9 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/

Questions - ???