A Basic Cloning Methodology for z/VM Systems

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Thursday, August 27, 2009
Session 9169
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Overview

• Why, What & How of Cloning
  • Why cloning?
  • What are we cloning?
  • How are we cloning?

• Demo: Cloning An Active z/VM System

• Summary: What’s Next…
The Why, What & How of Cloning

- **Why Cloning?**
  - Standardized configurations
  - Facilitates maintenance testing & rollout
  - Time savings
  - Cost savings
The Why, What & How of Cloning

• What Are We Cloning?
  • Operating Systems That Run On System z
    • z/OS: Large enterprise class systems
    • z/Linux: Linux based server systems
    • z/VM: A Hypervisor for operating systems
The Why, What & How of Cloning

- Cloning z/OS
  - z/OS was the first operating system that we cloned
  - We now have 18 z/OS systems across 2 data centers (and growing)
  - Takes the longest to clone: ~ 2.0-2.5 Hours
  - Cloned by running ~50 batch jobs in z/OS environment
The Why, What & How of Cloning

• Cloning Virtual Linux Servers Was Next
  • We have 20+ Virtual Servers (and growing)
  • Virtual Servers are cloned in minutes (< 5 minutes)
    • 15-20 minutes if Flash Copy DASD feature not available
  • Cloning is via a “Controller” Linux Server
    • Methodology based on IBM Virtualization Cookbook
The Why, What & How of Cloning

• Finally, We’re Cloning z/VM Systems
  • Looked for a VM cloning process, didn’t find it, so created it
  • We now have 8 z/VM systems across 2 data centers (and growing)
  • Takes about 2-3 minutes to clone z/VM
    • But takes 20-30 minutes if Flash Copy is not available
  • Cloning is performed via a “Cloning” Virtual Machine
  • If all goes well, you’ll see a demo of this process …
The Why, What & How of Cloning

• How Is Cloning Accomplished?
  • Establish standards that support duplication
  • Establish a “Base” system as the prototype
  • Develop an automated cloning procedure
  • Procedure based on available utilities, i.e. Rexx, DDF, etc
  • Clone a system from a like system (my rule)
How We Are Cloning z/VM

• Our z/VM Cloning Criteria
  • Cloning process developed using z/VM 5.2.0
  • Running in a shared DASD environment
    • So each z/VM system must have unique volsers
  • Based On Shipped Configuration From IBM
    • Using a single, 3390-9 volume for SYSRES
    • Not Using Dirmaint, Shared File System, External Security, …
How We Are Cloning z/VM

- Cloning process is based on shipped configuration + User volume

z/VM Install Based On Shipped Configuration

Base System

520RES

3390-9

VM Cloning Process

520SPL

3390-3

New (Cloned) System

520PAG

3390-3

VM1RRS

3390-9 SYSRES

VM1RS1

3390-3 SPOOL

All Volumes Copied Except Paging Volumes

VM1RP1

3390-3 PAGE

VMUSR

3390-3

520USR

3390-3

VM1RJ1

3390-3 USER

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How We Are Cloning z/VM

• Two Files Must Be Modified In A Cloned System
  • SYSTEM CONFIG (Located on Parm Disk, i.e. CF1)
  • USER DIRECT (Shipped on MAINT’s 2CC minidisk)
How We Are Cloning z/VM

- Conventions/Standards For Cloning
  - Established a naming standard for System ID (SYSID)
  - Established a naming standard for system volumes
  - Added a User volume to the configuration
  - Created a minimal System Config “model file” for cloning
  - Created a minimal VM Directory “model file” for cloning
How We Are Cloning z/VM

• Naming Standard – SYSID
  • Using a 4-char SYSID to drive the cloning process
    • All system files can co-exist since names are unique (based on SYSID), i.e. System Configs, VM Directories, TCP/IP files, etc.
    • Volsers are also based on SYSID to make them unique
  • SYSID format: VMnx, where:
    • VM = Common prefix so VM systems & volumes are unique (from z/OS & z/Linux in our case)
    • n = a number that represents the data center
    • x = a letter to designate the VM system

SYSID=VM1R
How We Are Cloning z/VM

- Naming Standard – System Volsers
  - Volser format: VMnx + V# = VMnxV#
    - First 4 characters are the SYSID, i.e. VMnx (such as VM1R)
    - 5th character indicates volume type: V = R, P, S, U
    - 6th character is a number to keep same volume types unique: # = 1-9 (except SYSRES is always S, i.e. RS)
  - Note that current cloning process does not include TDISK volumes – we just haven’t needed them
    - TDISK volume type would be T, i.e. VM1RT1
    - Cloning can be modified to include TDISK’s (if you modify execs)
How We Are Cloning z/VM

• Why Add A User Volume?
  • Simplifies moving to a new version of z/VM
  • Simplifies maintenance via full SYSRES replacement
  • Easy to clone – just 1 more DASD volume to copy
• Conventions:
  • Always allocate new minidisks on the User volume
    • This means no more allocations on the SYSRES volume!
  • Using low-end cylinders for VM users (we only have a few)
  • Using high-end cylinders for VM tools, utilities & ISV software
How We Are Cloning z/VM

• Cloning Models Give Consistent Results
  • Cloning will only change volser for a new system
  • Cloning models should have basic definitions – you decide what they should be
    • System Config Model: fn=<Source Sysid> ft=$CONFIG$
    • User Directory Model: fn=<Source Sysid> ft=$DIRECT$
  • You can then modify the new files after cloning
    • New System Config: fn=<New Sysid> ft=CONFIG
    • New User Directory: fn=<New Sysid> ft=DIRECT

Note: fn means ‘file name’ & ft means ‘file type’
How We Are Cloning z/VM

• Preparation For Cloning
  • Setup a cloning virtual machine called: VMCLONER
    • Make sure it has the same authorities as MAINT, i.e.
      • Dir Option: DEVMAINT (Allows SET MDISK to work)
      • Dir Option: LNKNOPAS (Allows LINK w/o password)
      • Other Dir Options: MAINTCCW LNKE LNKS
  • Wrote Rexx execs to perform the cloning & IPL processes
    • Rexx execs only use utilities shipped with z/VM
      • DDR, CPFMTXA
    • 3 Rexx execs accomplish Cloning & IPL
      • CLONEVM – Performs the cloning process
      • IPLVM – Performs an IPL of the cloned system
      • TESTIPL – IPLVM front-end with instructions for 1st IPL
How We Are Cloning z/VM

• Two Cloning Modes To Choose From
  • Active Mode – The original cloning method
    • Cloning source (volumes) based on VM system you logged onto
    • The original cloning process was based on active mode only
    • Use this method after installing the z/VM starter system
    • Warning: This mode does not support cloning an active system that you are not logged onto!
  • Static Mode – Cloning enhancement
    • Cloning source is from static, non-active VM system volumes
    • This method allows you to establish a “golden image” for cloning:
      • Install the starter system and clone it using Active Mode
      • IPL & customize the cloned system, i.e. add SFS, External Security, DirMaint, etc.
      • After customizing, shut it down, then use it as a golden image via static cloning from another VM system, i.e. the starter system
How We Are Cloning z/VM

- Choice Of Naming Standards
  - Using our Naming Standards is optional
  - Depends on specified parameters whether or not our SYSID and Volser naming standards are enforced
  - If you do use your own standards, make sure they’re correct!
  - See the comments in the default parameter file for details
    - Default parameter file: CLONEVM $PARMS$ A1
How We Are Cloning z/VM

• Overview Of The Cloning Process
  • Execute the CLONEVM exec:  CLONEVM sysid
    • The cloning process consists of 11 steps
    • There are many prompts during it’s execution, so that it can be easily aborted if something doesn’t look right
    • Execution results are written to a log file: sysid $LOG$ A1
  • Execute the TESTIPL exec:  TESTIPL sysid
    • Front-end to the IPLVM exec
    • Calls the IPLVM exec after displaying 1st IPL instructions
    • IPLVM execution results are written to: sysid $IPL$ A1
  • Hopefully you’ll see how this works during the demo …
How We Are Cloning z/VM

• Cloning Process …
  • Determine the SYSID for a new VM system, i.e. VM1R
  • Logon to the VMCLONER virtual machine
  • Execute the CLONEVM exec: CLONEVM vm1r
  • It looks for a parameter file, i.e. VM1R $PARMS$ A1
  • If exists, asks if you want to make changes (via XEDIT)
  • If it doesn’t exist, it will create a new one and enter XEDIT
  • Edit the parameter file to specify (or change if not 1ˢᵗ time):
    • The SYSID of the new system: VM1R
    • The DASD addresses for the new system
    • The Source SYSID that you’re cloning from
    • The Source Volser Prefix you’re cloning from
    • The Source Model files for the System Config & User Directory
    • Finally, save the parameter file with these changes, i.e. FILE command
How We Are Cloning z/VM

- Editing the parameter file:

```
VM1R     $PARMS$  A1  F 80  Trunc=80 Size=161 Line=0 Col=1 Alt=0
====>
00000  * * * Top of File * * *
00001  *=====================================================================
00002  * ===> Parameter File For Cloning A New VM System <====
00003  *=====================================================================
00004 00005  * < Specify Source & Target Information For Cloning A New System >
00006 00007  *=====================================================================
00008  * New (Target) System Information
00009  *=====================================================================
00010  * Specify The New (Target) System & DASD Volumes That Will Be Cloned To:
00011
00012  NewID     = VM1R
00013
00014  NewResA   = BA65
00015  NewResV   = VM1RRS
   .
```
How We Are Cloning z/VM

• Cloning Process …

• 11 steps are executed by the CLONEVM exec:
  1. GetParms – Reads/Edits cloning parameters from a file
  2. DefVols – Defines volsers & verifies addresses
  3. ClipVols – Clips the volsers of all target DASD
  4. LinkVols – Links to all source & target volumes
  5. CloneDir – Clones the VM Directory source file
  6. CloneCfg – Clones the System Config file
  7. CloneVol – Clones the new system volumes
  8. WriteDir – Writes VM Directory to new SYSRES
  9. PageVols – Formats the new PAGE volume(s)
  10. Transfer – Transfers files if cloning a static system
  11. FirstIPL – First IPL of cloned system to clear spool
How We Are Cloning z/VM

• Cloning Process …
  • Once CLONEVM has completed, then run TESTIPL
    • The TESTIPL Rexx exec provides instructions on performing the first IPL of a newly cloned system, then calls the IPLVM Rexx exec
      • Specify the new SYSID as a parameter to TESTIPL
        • For example: TESTIPL vm1r
    • The IPLVM Rexx exec allows you to easily run another VM system “2nd level”
      • The IPLVM exec defines terminals so you can dial into VMCLONER locally to check out the new system
      • TCP/IP access is also possible, but you’ll have to set it up to work in your environment! (see IPLVM exec comments)
How We Are Cloning z/VM

• Instructions displayed by the TESTIPL exec

TESTIPL: About To Perform An IPL Of VM System: VM1R ...
-----------------------------------------------------------------
> If This Is The First IPL Of VM1R, Then Follow These Guidelines:

1) When The SAPL Screen Is Displayed, Specify: PROMPT FN=VM1R

2) Press PF10 To Proceed With The IPL Using These Options

3) When Prompted For Start Options, Specify: COLD DRAIN

4) When The TOD Prompt Is Given, Specify: NO

5) There Will Be Several Prompts For Spool Files, Reply: GO
-----------------------------------------------------------------
==> About To Begin The IPL, Continue (Y/N) ? (Enter=Y):
Where Do We Go From Here…

- Lots of room for improvement in this cloning process, but it’s a start!
- Some of the improvements that are in the works:
  - Working on panel displays for entering cloning parameters
  - Working on a Read-Only SYSRES configuration
  - Working on further developments based on a read-only SYSRES that will assist in applying maintenance to z/VM
  - Adapt to work with Shared File System (SFS)
  - Adapt to work with directory maintenance software, i.e. Dirmaint, etc
  - Adapt to work with external security software, i.e. RACF, etc
- If you’re interested in a copy of the current execs (and this presentation) shoot me an email at: james.moling@fms.treas.gov