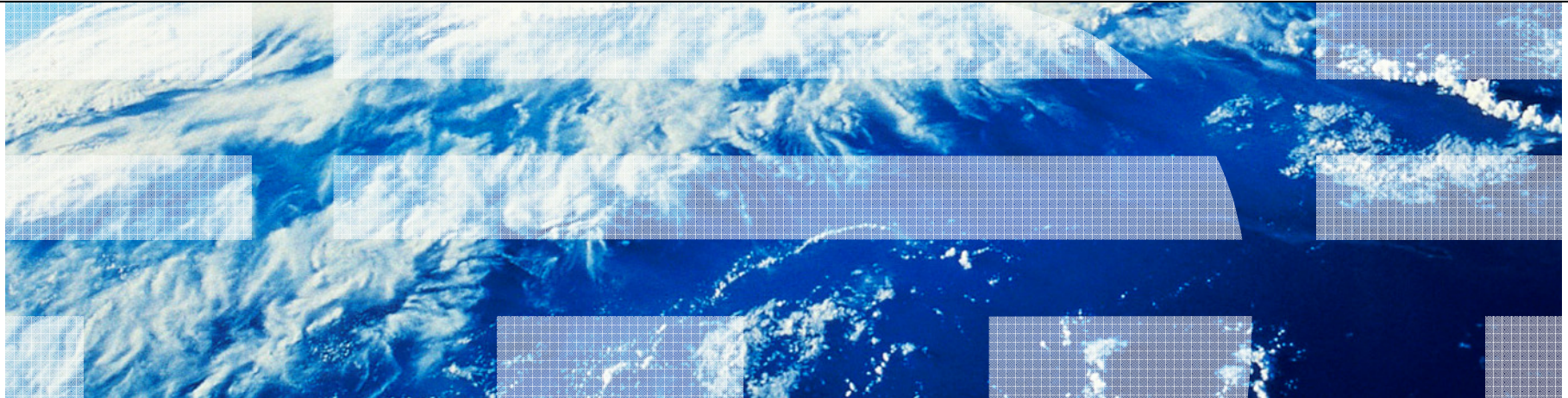


Cloning zFS in a Shared File System Environment



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- Cloning Review:
 - Why you clone
 - Cloning assumptions
- Differences: data sets and file systems, and HFS and zFS
- Catalog's Role in using file systems
- Shared file system concepts
- Installing and Servicing for a shared file system environment
- Copying file system data sets
- zFS indirect cataloging support
- Cloning assistance provided
- A note about quiescing file systems
- Extra! Dynamic activating z/OS UNIX corrective service

Cloning Review: Why We Clone



- At some point after you have finished installing z/OS software you will probably need to make a copy of it (“clone” it)
- Some reasons are:
 - For backup
 - A backup copy is a copy of the z/OS product set (z/OS and other products you have installed on the same set of volumes using the same SMP/E zones) that:
 - Resides on different volumes with different volume labels
 - Includes copies of the associated SMP/E zones with different names that point to the data sets on the new volumes
 - May include copies of the associated catalogs with different names
 - Can be IPLed in place of the original copy when the necessary setup has been done after making the copy
 - To move the software to another system (“deployment”)
 - To create another SMP/E-serviceable copy for installing service or other products

Cloning Review: Cloning Assumptions

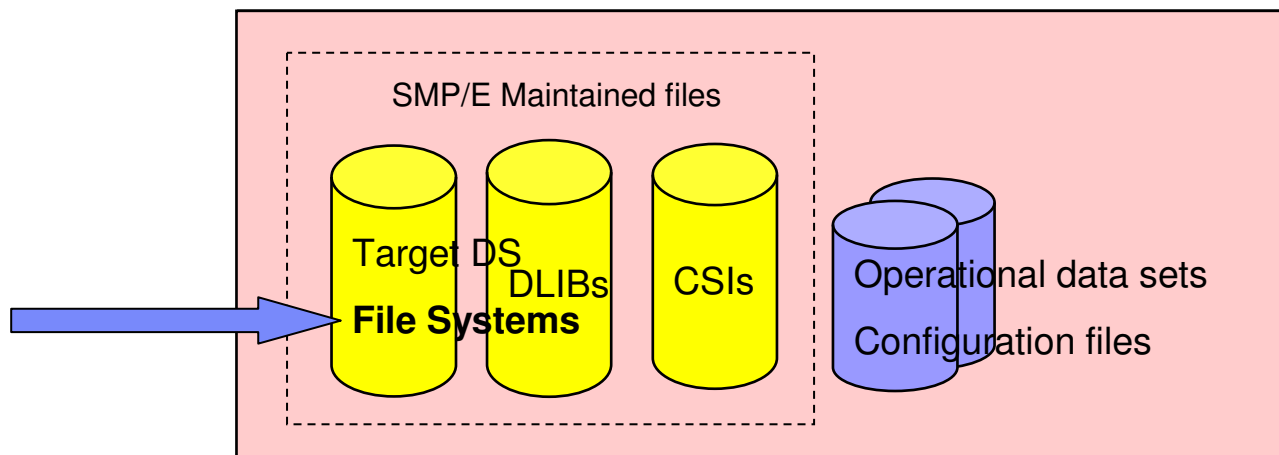


- **Cloning should include:**

- The current target software instance (target PDS and PDSEs, z/OS UNIX file system data sets, optionally dlibs, and SMP/E CSIs)

- **Cloning may also include:**

- Appropriate operational data sets and configuration files



- For this presentation, we'll focus specifically on the z/OS UNIX file system data sets.

- PDS and PDSE cloning do not seem to raise as many questions as z/OS UNIX file system data sets do!
- SMP/E CSI data sets and entries are not covered, but remember that your SMP/E CSI should be updated as part of the cloning activity, and all DDDEF entries should have a correct location and name!

Differences between MVS data sets and z/OS UNIX mounted file systems



- Two different MVS data sets with the same name can be actively accessed on a single system as long as they reside on different volumes (with different volume serials) and they both do not need to be cataloged.
 - You need to specify somehow which data set you want by providing the volume serial where it resides.

- Two different z/OS UNIX file systems with the same data set name, cannot be mounted at the same time on a single system nor in a shared file system environment (even if you try to use different z/OS UNIX mount point directories) and they need to be cataloged to be mounted.
 - This is an existing restriction since the beginning of z/OS UNIX.

z/OS UNIX File System Data Sets



- z/OS UNIX File System Data Sets contain many important parts of the z/OS operating system and associated products:
 - TCP/IP, z/OS Shells and Utilities, Infoprint Server, Java SDK, XML Toolkit, Ported Tools, ...
- The choice today for z/OS Unix file system data sets is:
 - HFS**: Stabilized. Non-VSAM data set.
 - Can be indirectly cataloged just as target library PDS and PDSEs can.
 - Both cataloged and uncataloged HFS can be on non-SMS DASD.
 - Cataloged HFS can be multi-volume on SMS-DASD (up to 255 extents on 59 volumes with up to 123 extents per volume)
 - zFS**: Enhancements provided that customers need! VSAM LDS, therefore must be cataloged.
 - Support for indirectly cataloged zFS (not VSAM LDS in general!)
 - Non-SMS or SMS, can be up to 59 volumes. (EAS-eligible on EAVs!)
 - Indirect catalog zFS support is limited to one volume, however
 - Architected maximum size for an aggregate: 4 TB

- VSAM data sets must be cataloged to access them (regardless of whether they are mounted).
- VSAM must be SMS-managed (needs a STORAGECLASS) if larger than 4 GB.
Needs a DATACLASS that provides extended addressability
 - (4 GB is about 5825 cylinders of 3390 DASD)
- All SMS-managed data sets must be cataloged.
- In a nutshell, for cloning: It's the catalog.

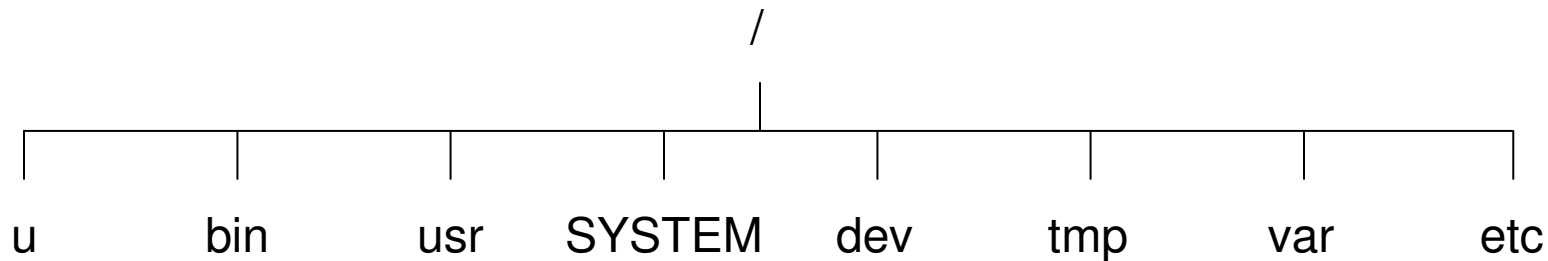
Catalog's role in accessing data sets



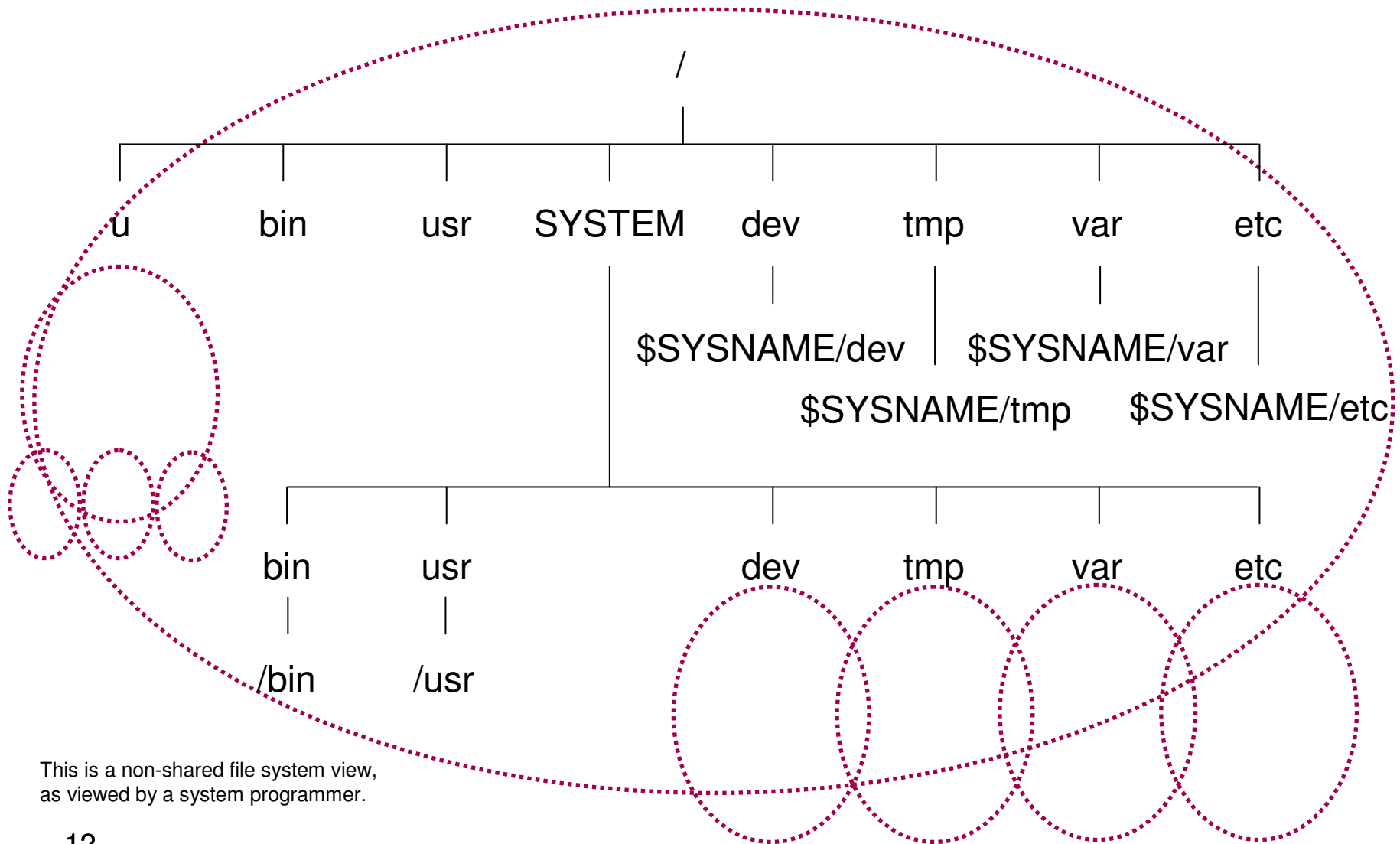
- Master Catalog identified in
 - LOADxx member of SYS1.PARMLIB, or
 - SYSCATxx member of SYS1.NUCLEUS
- User Catalogs defined in Master Catalog, and often used for VSAM data sets.
 - DEFINE ALIAS NAME(HLQ) RELATE(USERCAT.HLQ)
 - USERCAT.HLQ -> user catalog that contains data sets that begins with HLQ
- System Symbolics and Extended Alias in catalog entries:
 - For the volume: **NONVSAM** ----- SYS1.LINKLIB ... VOLUMES
VOLSER----- &SYSR1. DEVTYP-----X'00000000'
NONVSAM ----- OMVS.ROOT.HFS ... VOLUMES
VOLSER----- &SYSR1. DEVTYP-----X'00000000'
 - For aliasing a data set name: ALIAS ----- SYS1.PRODUCT ...
ASSOCIATIONS SYMBOLIC- **SYS1.&SYSR1..PRODUCT**
RESOLVED-SYS1.ZD113.PRODUCT
 - For user catalog names: ALIAS ----- SYS1.ZFS ...
ASSOCIATIONS SYMBOLIC- **&ZFSL..UCAT** RESOLVED-ZCSDW.UCAT
 - For zFS indirect exploitation: **CLUSTER** ----- ZFS.ROOT ... VOLUME
VOLSER----- &ZFSL DEVTYP-----X'00000000'

- In a Shared File System environment (BPXPRMxx specifies SYSPLEX(YES) on all systems):
 - There is a single z/OS UNIX file system hierarchy across the multiple systems in the shared file system environment.
 - When a z/OS UNIX file system is mounted, it is globally mounted across all the systems.
 - Once a file system (name) is mounted into the z/OS UNIX file system hierarchy, you cannot mount a file system with the same name.
 - On the same mount point or even a different mount point.
 - Several z/OS releases or service levels can be active in the shared file system environment at the same time.

- This is how an end user views the “top” of the z/OS UNIX hierarchical file system.
- It looks like files and directories organized in a hierarchical tree:

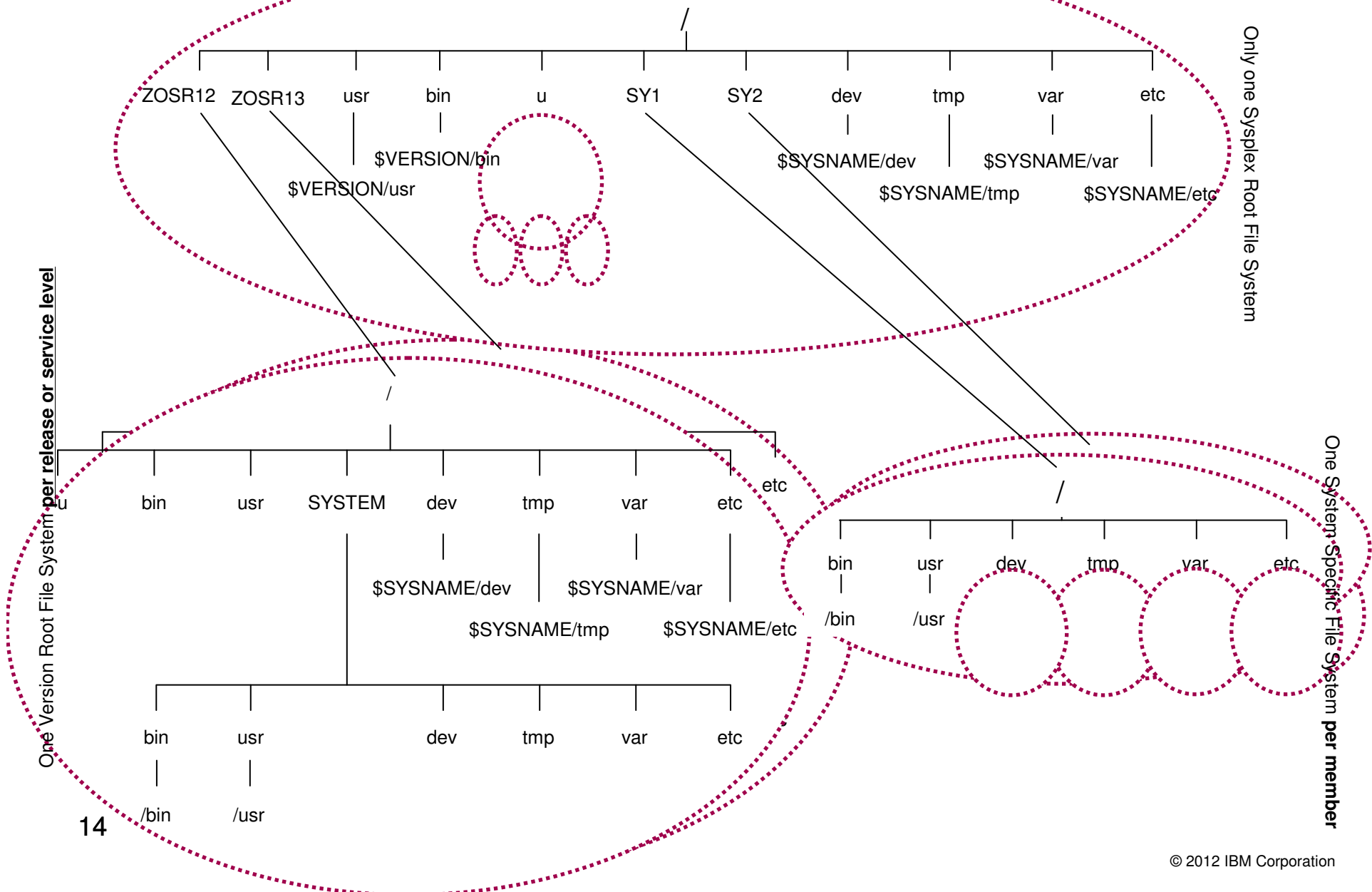


The z/OS UNIX hierarchical file system



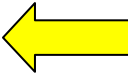
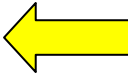
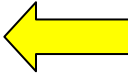
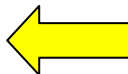
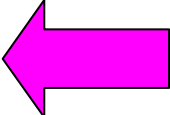
- **Sysplex root:**
 - Only one for all systems in the shared file system environment
 - Does not contain z/OS system software itself, but contains directories from which you mount z/OS system software.
 - Is very small and should be mounted read-only. *
- **System-specific file systems:**
 - One per member in the shared file system environment.
 - A place where system-specific file systems are mounted (/etc, /var, /tmp, /dev)
 - Does not contain z/OS system software itself.
 - Is very small and should be mounted read-write.
- **Version root file systems:**
 - Contains the z/OS system software!* This is where cloning is concerned.
 - Is rather large (thousands of cylinders)
 - Should be mounted read-only. *

The z/OS UNIX sysplex shared file system hierarchical file system



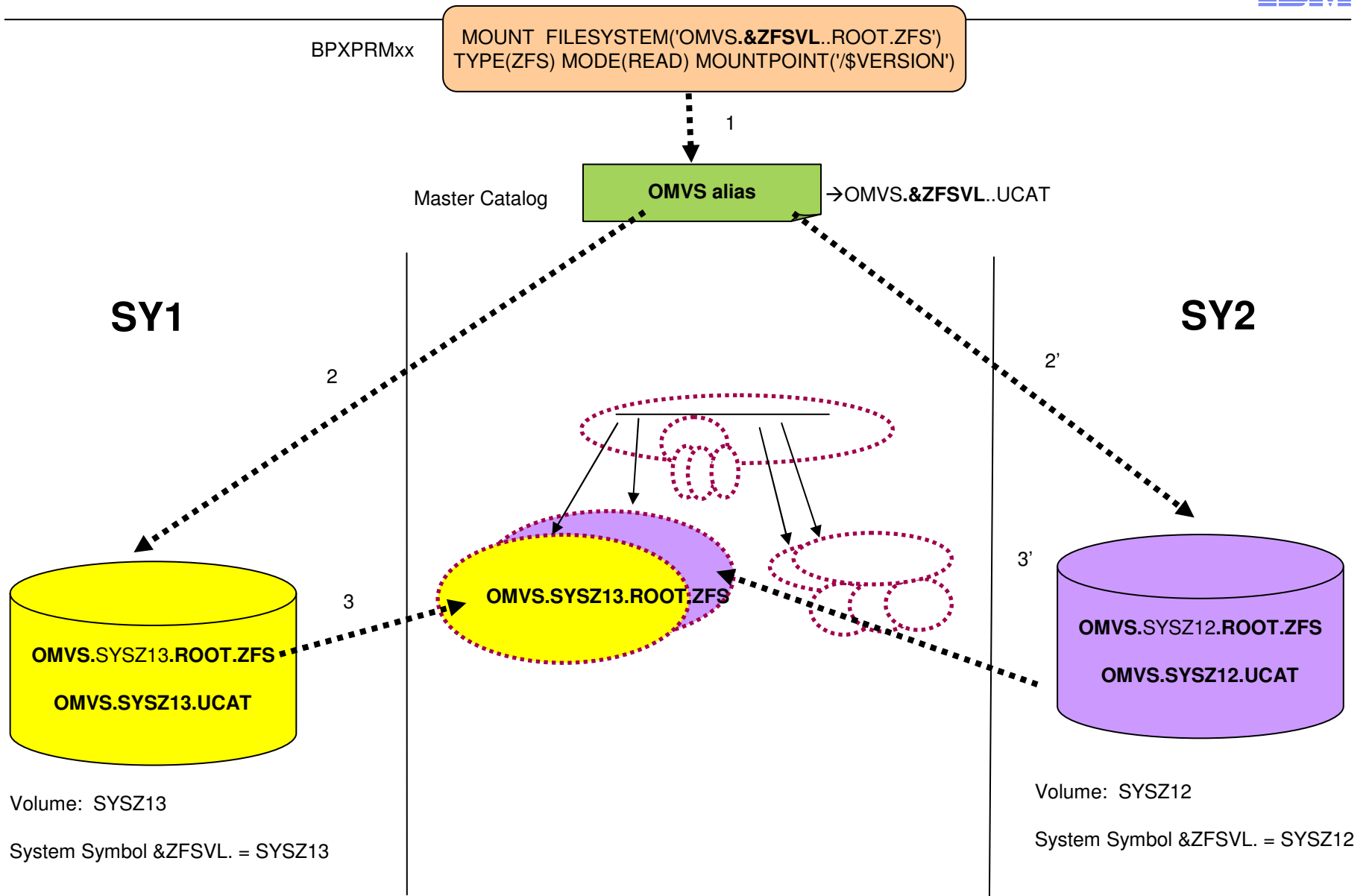
Some BPXPRMxx Statements for a Shared File System Specification



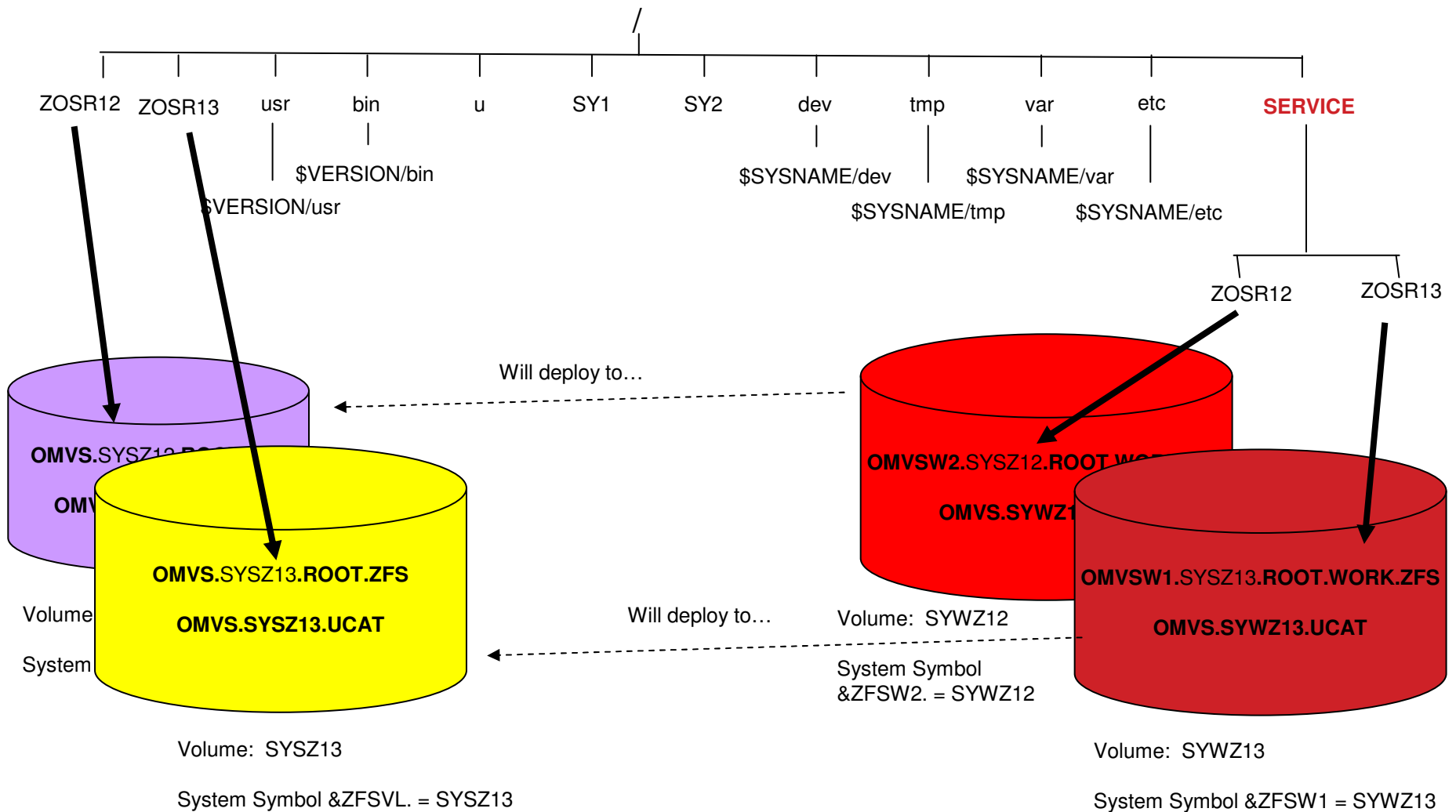
- SYSPLEX(YES)  Indicates using shared file system environment
- VERSION('ZOSR13')  Indicates how you want the version identified
- ROOT FILESYSTEM('OMVS.SYSPLEX.ROOT') TYPE(ZFS)
MODE(READ)  The sysplex root – the same for every system
- MOUNT FILESYSTEM('OMVS.&SYSNAME..SYSTEM.ZFS') TYPE(ZFS)
MODE(RDWR) UNMOUNT MOUNTPOINT('/&SYSNAME.')  The system-specific file system
- **MOUNT FILESYSTEM('OMVS.&ZFSVL..ROOT.ZFS') TYPE(ZFS)
MODE(READ) MOUNTPOINT('/\$VERSION')**  The version root – shared between systems if applicable
- MOUNT FILESYSTEM('OMVS.&SYSNAME..ETC') TYPE(ZFS)
MODE(RDWR) UNMOUNT MOUNTPOINT('/&SYSNAME./etc')

...

An Execution Example:



A Servicing Example: (same sysplex)



A Service Example:

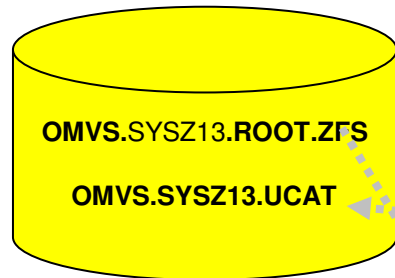


BPXPRMxx

```
MOUNT FILESYSTEM('OMVS.&ZFSVL..ROOT.ZFS')
TYPE(ZFS) MODE(READ) MOUNTPOINT('/$VERSION')
```

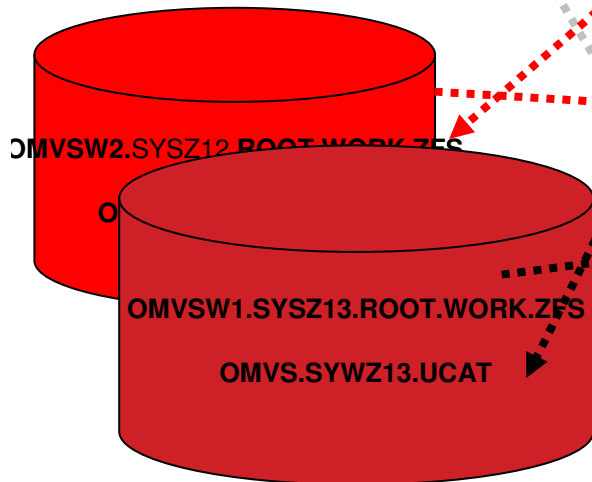
```
MOUNT FILESYSTEM('OMVSW1.SYSZ13.ROOT.WORK.ZFS ')
TYPE(ZFS) MODE(READ) MOUNTPOINT('/SERVICE/ZOS13')
```

SY1 (Driving System)



Volume: SYSZ13

System Symbol &ZFSVL. = SYSZ13

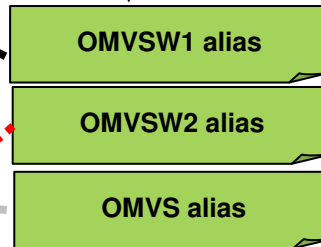


Volume: SYWZ13

System Symbol &ZFSW1 = SYWZ13

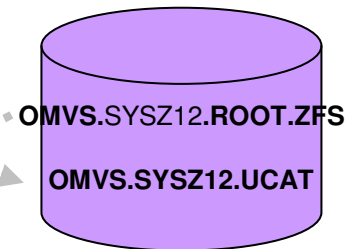


Master Catalog



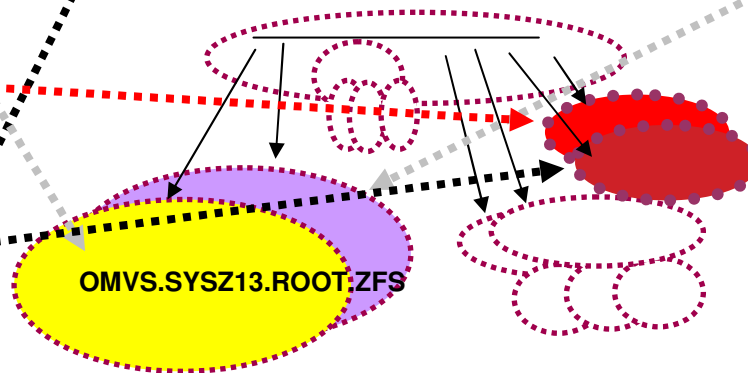
1

SY2



Volume: SYSZ12

System Symbol &ZFSVL. = SYSZ12



A Service Example with “Flip Flop” in use:

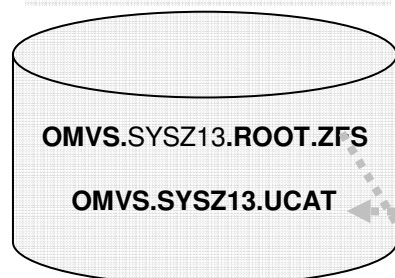


BPXPRMxx

```
MOUNT FILESYSTEM('OMVS.&ZFSVL..ROOT.ZFS')
TYPE(ZFS) MODE(READ) MOUNTPOINT('/$VERSION')
```

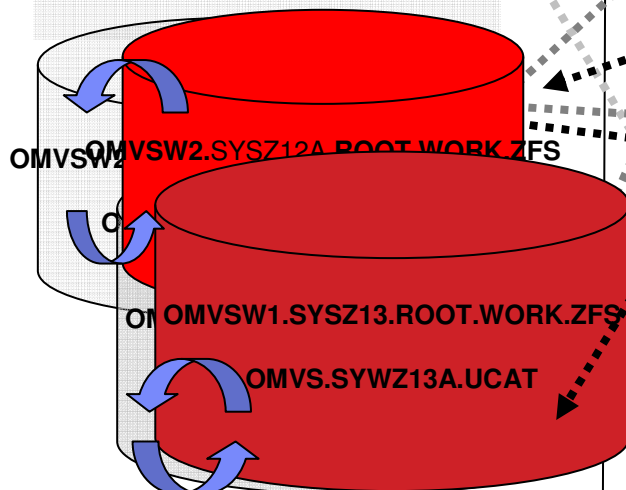
```
MOUNT FILESYSTEM('OMVSW1.SYSZ13.ROOT.WORK.ZFS')
TYPE(ZFS) MODE(READ) MOUNTPOINT('/SERVICE/ZOS13')
```

SY1 (Driving System)



Volume: SYSZ13

System Symbol &ZFSVL. = SYSZ13



Volume: SYZ13A

System Symbol &ZFSW1A = SYZ13A

Master Catalog

OMVSW1 alias

→OMVS.&ZFSW1..UCAT

OMVSW2 alias

→OMVS.&ZFSW2..UCAT

OMVS alias

→OMVS.&ZFSVL..UCAT

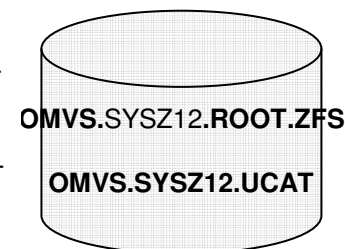
OMVSW1A alias

→OMVS.&ZFSW1A..UCAT

OMVSW2A alias

→OMVS.&ZFSW2A..UCAT

SY2



Volume: SYSZ12

System Symbol &ZFSVL. = SYSZ12

OMVS.SYSZ13.ROOT.ZFS

“Flip Flop” allows you to alternate between using different target volumes.



Some observations for this example:



- zFS was used, but it very well could have been HFS! Since the file system must be cataloged to be mounted and accessed, it makes no difference in our example whether we used HFS or zFS. We were looking at the placement of the file systems, and how they were cataloged so that we could get access to them concurrently.
- The driving and target systems were in the same sysplex, and shared volumes.
 - This is a more complicated case than across-sysplexes, where sharing isn't done. The alias names in the same sysplex – when sharing the master catalog – cannot clash. Across sysplexes, the alias names used could be in common.
- The alias names used (OMVS , OMVSW1, and OMVSW2) could have used the target zone name, the volume name, or another name that is helpful for you.
 - System symbols for the usercat names were used, but aren't necessary.
- The SERVICE mountpoints (ZOSR13 and ZOSR12) happen to match the BPXPRMxx VERSION names. They could have been the target zone name, the volume name, or another name that is helpful for you.

How do I copy the version root file system, with cataloging in mind?



- Most people copy the file system data set using MVS utilities (as opposed to z/OS UNIX utilities like pax or copytree).
 - We will assume DFSMSdss will be used.
- How you copy your z/OS system software data sets relies upon your environment for deployment:
 - Same sysplex or across sysplexes? Shared volumes? Installation data set names different from execution data set names? SMS-managed?
 - We'll assume the environment we've shown previously. Other ways may work just as well.
- To copy (clone) the version root file system (either HFS or zFS), decide if you want:
 - Full volume copy: will copy the entire volume (which may be more than you want or need, depending on your environment). Note that this gives you another copy of the file system with the same name, and only one can be cataloged at a time. Therefore, a subsequent rename or recatalog may be necessary after this sort of copy if you want to access it.
 - If you have any usercats on the volume, a full volume copy isn't a good choice. For zFS file systems that are using a usercat on the volume, this is not a recommended choice.
 - Data set copy:
 - Logical data set copy: can rename the file system on the copy operation, and depending on your catalog structure may be immediately accessible. A popular choice that works well in many situations. (z/OSMF's Software Deployment task uses this method.)
 - Physical data set copy: will provide you with a copy of the file system data set that is not cataloged. A subsequent rename or recatalog may be necessary. Note that a rename on a physical data set copy is not currently available.
 - If you are using indirect zFS cataloging, this copy method is best, as you will be using an existing catalog entry that makes the file system accessible.

Logical data set copy for file system sample



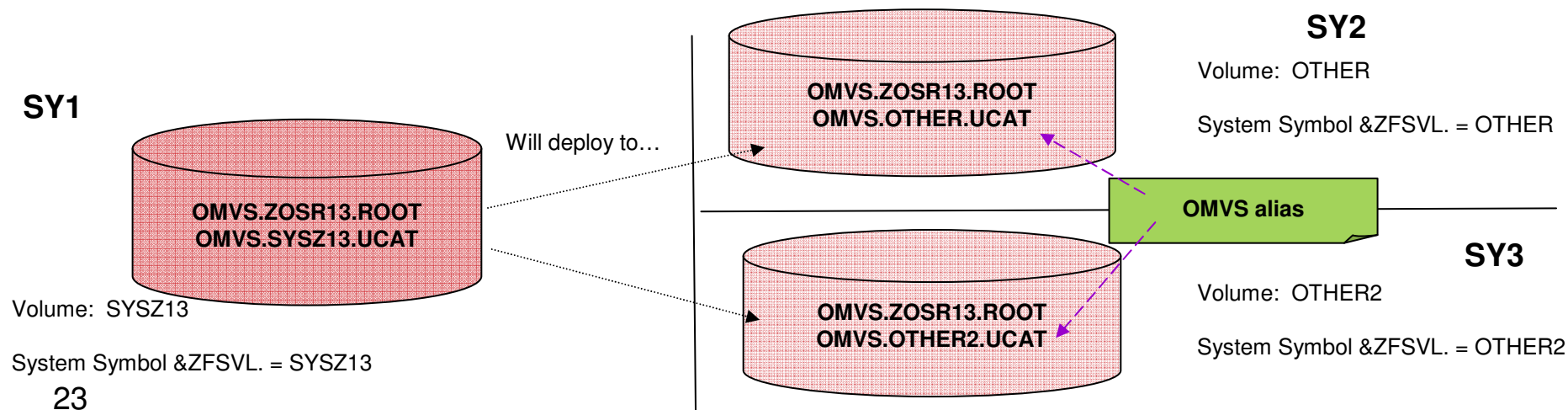
```
//COPYFS      EXEC  PGM=ADRDSSU,REGION=0M
//SYSPRINT    DD  SYSOUT=*
//SYSIN       DD      *
COPY DATASET( -
INCLUDE(OMVSW1.SYSZ13.ROOT.WORK.ZFS)) -
RENAMEU(OMVSW1.SYSZ13.ROOT.WORK.ZFS, -
        OMVS.SYSZ13.ROOT.ZFS) -
OUTDYNAM(SYSZ13) -
CATALOG ALLDATA(*)  ALLEXCP -
CANCELERROR
```

- This is applicable to either HFS or zFS.
 - Logical data set copy is not recommended if using zFS indirect cataloging support (which relies upon a system symbol for the volume name).
- CATALOG follows normal catalog search order.

zFS Indirect Cataloging Support (as of zOS R12)



- Allows for use of a system symbol as the volser for zFS data sets (not other VSAM LDS data sets).
- Provides a simple and flexible way to clone zFS data sets, where you do not need to rename the data set during the copy.
 - Ideal for environments where the file system name doesn't need to change between the driving system and target system.
 - May share mcat on those deployed target systems. (Remember that unique mount name requirement, though!)
 - Includes all non-shared file system environments.



Using zFS Indirect Cataloging Support:

Physical data set copy for file system sample



```
//COPYFS      EXEC  PGM=ADRDSSU,REGION=0M
```

```
//SYSPRINT   DD  SYSOUT=*
```

```
//SYSIN      DD      *
```

```
  COPY DATASET( INC(OMVS.ZOSR13.ROOT)) -
```

```
    PHYSINDYNAM ( (SYSZ13) ) -
```

```
    OUTDYNAM ( (OTHER) ) -
```

```
    ALLDATA(*)
```

- Creates an uncataloged copy.
- Cannot currently rename data sets during a physical copy.
- See quiescing note, may want to unmount file system first.

```
//RENAME      EXEC  PGM=IDCAMS,REGION=0M
```

```
//SYSPRINT   DD  SYSOUT=*
```

```
//SYSIN      DD      *
```

```
  DEFINE CLUSTER -
```

```
    (NAME(OMVS.ZOSR13.ROOT) -
```

```
    LINEAR -
```

```
    VOLUMES(&ZFSVL) -
```

```
    RECATALOG)
```

- Recatalogs the zFS to start using the system symbol for the volume.
- Only needs to be recataloged once, so subsequent deployments can reuse the catalog entry!

A note about quiescing...



- When file systems (either HFS or zFS) are mounted and they need to be copied or dumped, you need to understand about quiescing.
- When doing an DFSMSdss logical COPY or DUMP on a mounted file system, DFSMSdss automatically will quiesce the file system.
- When doing a physical COPY or DUMP on a mounted file system, DFSMSdss does not automatically quiesce the file system.
 - This means that exclusive ENQs may not succeed during the physical COPY or DUMP operation.
 - To avoid exclusive ENQ failures, you can:
 - Unmount the file system prior to the COPY or DUMP
 - **Attention:** Exercise caution if you use TOL(ENQF) during a physical copy or dump of zFS data sets. Unlike other types of data sets, if a zFS data set is updated during a physical copy or dump with TOL(ENQF), it will likely result in an unusable data set.
- *Having a zFS mounted read-write during any copy or dump may result in delays when the copied file system is subsequently used. Avoid the delays by unmounting the file system before the copy or dump.*

- Documentation: z/OS Planning for Installation, Appendix D.
Making a copy of your system software (cloning)
- JCL samples: IEACLN* samples in SYS1.SAMPLIB
- z/OSMF's Software Deployment (for z/OS R13):
 - Use a GUI interface to define software instances and deployments.
 - Supports a local (same sysplex) deployment, or a remote (across sysplexes) deployment.
 - Produces customized JCL jobs for cloning, for you to run.
 - Supports HFS and zFS, but not zFS indirect cataloging.

z/OSMF Software Deployment



IBM z/OS Management Facility - Mozilla Firefox

File Edit View History Bookmarks Tools Help

IBM z/OS Management Facility x IBM z/OS Management Facility x IBM 1.3.2.3 "z/OS V1R13 DFSMS U... x +

https://zplexb.wsclab.washington.ibm.com:32208/zosmf/

IBM z/OS Management Facility Welcome mwalle Log out IBM

■ Welcome
+ Configuration
+ Links
+ Performance
+ Problem Determination
- Software
 ■ Deployment
+ z/OS Classic Interfaces
+ z/OSMF Administration
Refresh

Welcome x Deployment x

Deployment > Deploy Software > Deployment Checklist Help

Deployment Checklist

To deploy a software instance, complete the checklist.

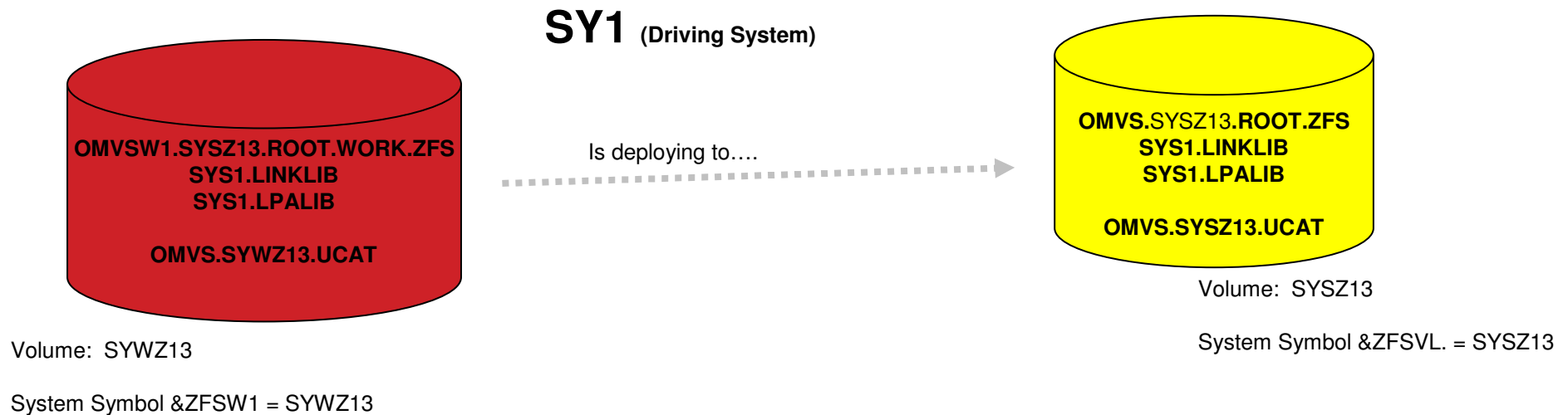
Checklist

Progress	Step
⇒	1. Specify the properties for this deployment.
	2. Select the software instance to deploy.
	3. Select the objective for this deployment.
	4. Check for missing SYSMODs. • View missing SYSMOD reports.
	5. Configure this deployment.
	6. Define the job settings. z/OSMF creates the deployment summary and jobs. • View the deployment summary. • View the deployment jobs.
	7. Specify the properties for the target software instance.

Close

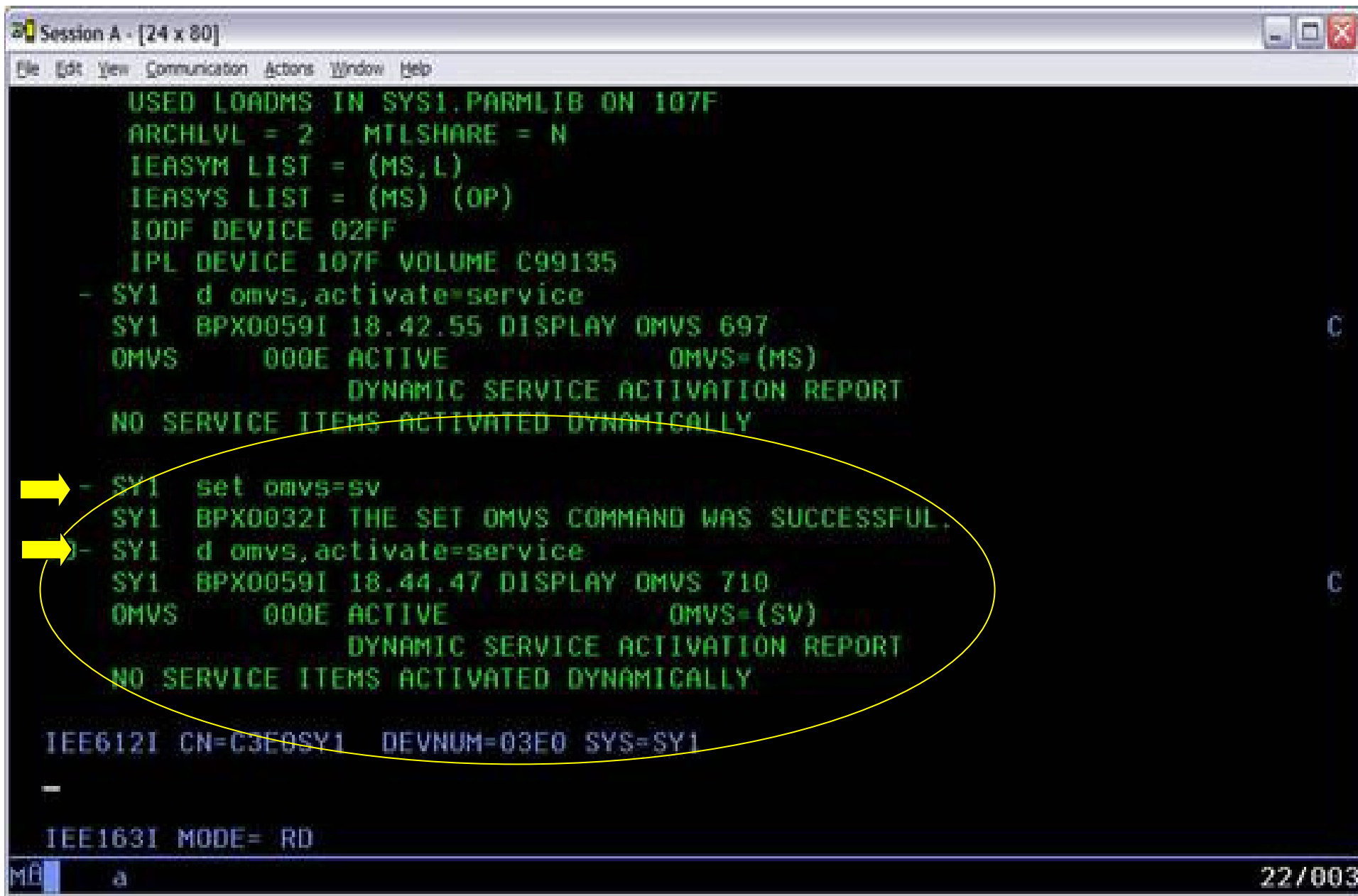
x Find: extended ⬇ Next ⬆ Previous Highlight all Match case

Dynamically Activating z/OS UNIX Service



To Use z/OS UNIX Dynamic Service Activation:

- 1.SMP/E install the corrective PTF on the “**work**” volume. (Allowed PTFs will be marked with ++HOLD DYNACT.)
- 2.Set BPXPRMxx on “**live**” system, point to the target LINKLIB and LPALIB on “**work**”
 - “**work**” LINKLIB and LPALIB must be APF authorized on “**live**” system
- 3.F OMVS,ACTIVATE=SERVICE to activate
- 4.D OMVS,ACTIVATE=SERVICE to view
- 5.F OMVS,DEACTIVATE=SERVICE to deactivate



```
Session A - [24 x 80]
File Edit View Communication Actions Window Help

USED LOADMS IN SYS1.PARMLIB ON 107F
ARCHLVL = 2 MTLSHARE = N
IEASYM LIST = (MS,L)
IEASYS LIST = (MS) (OP)
IODF DEVICE 02FF
IPL DEVICE 107F VOLUME C99135
- SY1 d omvs,activate=service
SY1 BPX0059I 18.42.55 DISPLAY OMVS 697
OMVS 000E ACTIVE OMVS=(MS)
DYNAMIC SERVICE ACTIVATION REPORT
NO SERVICE ITEMS ACTIVATED DYNAMICALLY

- SY1 set omvs=sv
SY1 BPX0032I THE SET OMVS COMMAND WAS SUCCESSFUL.
- SY1 d omvs,activate=service
SY1 BPX0059I 18.44.47 DISPLAY OMVS 710
OMVS 000E ACTIVE OMVS=(SV)
DYNAMIC SERVICE ACTIVATION REPORT
NO SERVICE ITEMS ACTIVATED DYNAMICALLY

IEE612I CN=C3E0SY1 DEVNUM=03E0 SYS=SY1
-
IEE163I MODE= RD

MB a 22/003
```

```
Session A - [24 x 80]
File Edit View Communication Actions Window Help

NO SERVICE ITEMS ACTIVATED DYNAMICALLY

- SY1  set omvs=sv
SY1  BPX0032I THE SET OMVS COMMAND WAS SUCCESSFUL.
- SY1  d omvs,activate=service
SY1  BPX0059I 18.44.47 DISPLAY OMVS 710
OMVS      000E ACTIVE          OMVS=(SV)
      DYNAMIC SERVICE ACTIVATION REPORT
NO SERVICE ITEMS ACTIVATED DYNAMICALLY

- SY1  f omvs,activate=service
SY1  BPXM059I ACTIVATE=SERVICE REQUEST FAILED, LINKLIB LIBRARY NOT APF
      AUTHORIZED
- SY1  SETPROG APF,ADD,DSNAME=SYS1.LINKLIB,VOLUME=C99134
SY1  CSV410I DATA SET SYS1.LINKLIB ON VOLUME C99134 ADDED TO APF LIST
- SY1  f omvs,activate=service
SY1  BPXM059I ACTIVATE=SERVICE REQUEST FAILED, LPALIB LIBRARY NOT APF
      AUTHORIZED
00- SY1  SETPROG APF,ADD,DSNAME=SYS1.LPALIB,VOLUME=C99134
SY1  CSV410I DATA SET SYS1.LPALIB ON VOLUME C99134 ADDED TO APF LIST
IEE612I CN=C3E0SY1  DEVNUM=03E0 SYS=SY1

-
IEE163I MODE= RD

M&  a 22/003
```

```

Session A - [24 x 80]
File Edit View Communication Actions Window Help

- SY1 f omvs,activate=service
SY1 BPXM061I THE FOLLOWING SERVICE ITEMS WILL BE ACTIVATED:
SY1      0A20708
SY1 ECSA STORAGE BYTES:                0 AND OMVS PRIVATE STORAGE BYTES:
    32768
SY1 WILL BE CONSUMED FOR THIS ACTIVATION.
SY1 *04 BPXM061D REPLY "Y" TO PROCEED WITH ACTIVATION. ANY OTHER REPLY
    ENDS THE COMMAND.
- SY1 4,y
SY1 IEE600I REPLY TO 04 IS;Y
SY1 BPXM062I ACTIVATE-SERVICE REQUEST COMPLETED SUCCESSFULLY
- SY1 d omvs,activate=service
SY1 BPX0059I 18.53.25 DISPLAY OMVS 749
OMVS      000E ACTIVE                OMVS=(SV)
        DYNAMIC SERVICE ACTIVATION REPORT

SET #    1:
  LINKLIB=SYS1.LINKLIB                VOL=C99134
  LPALIB =                            VOL=
      0A20708
  ECSA STORAGE:                0 OMVS STORAGE:        32768
IEE612I CN=C3E0SY1  DEVNUM=03E0 SYS=SY1

-
IEE163I MODE= RD

ME  a
22/003

```

```
Session A - [24 x 80]
File Edit View Communication Actions Window Help

DYNAMIC SERVICE ACTIVATION REPORT

SET # 1:
LINKLIB=SYS1.LINKLIB VOL=C99134
LPALIB = VOL=
0A20708
ECSA STORAGE: 0 OMVS STORAGE: 32768
- SY1 f omvs,deactivate=service
SY1 BPXM063I THE FOLLOWING SERVICE ITEMS WILL BE DEACTIVATED:
SY1 0A20708
SY1 *05 BPXM063D REPLY "Y" TO PROCEED WITH DEACTIVATION. ANY OTHER REPLY
ENDS THE COMMAND.
- SY1 5,y
SY1 IEE600I REPLY TO 05 IS;Y
SY1 BPXM065I DEACTIVATE=SERVICE REQUEST COMPLETED SUCCESSFULLY
- SY1 d omvs,activate=service
SY1 BPX0059I 18.56.07 DISPLAY OMVS 761
OMVS 000E ACTIVE OMVS=(SV)
DYNAMIC SERVICE ACTIVATION REPORT
NO SERVICE ITEMS ACTIVATED DYNAMICALLY
ECSA STORAGE: 0 OMVS STORAGE: 32768
IEE612I CN=C3E0SY1 DEVNUM=03E0 SYS=SY1
-
IEE163I MODE= RD
MA a 22/003
```

- **Data sets and file systems differences:** can actively access data sets with the same names on different volumes. Cannot mount (access) a file system with the same name as one already mounted.
- **HFS and zFS differences** - VSAM, and therefore catalog!
- **Catalog's Role in using file systems** – it's got to be cataloged to be mounted to be accessed. Use system symbols, use aliases!
- **Shared file system types:** sysplex root, system-specific, and version root file systems. Version root is where the cloning concerns usually stem.
- **Copying file system data sets** – volume or data set? Logical or physical copy? Keep catalog requirements in mind!
- **zFS indirect cataloging support** – best when file system names do not need to change when deploying
- **Quiescing** – know when it's done automatically for you, and what you may do when it's not automatic (unmount?)
- **Cloning assistance provided** – documentation, samples in SYS1.SAMPLIB, z/OSMF Software Deployment
- **Dynamic activating z/OS UNIX corrective service** - can save you an IPL!

- z/OS Planning for Installation, especially Appendix D
- z/OS DFSMS Managing Catalogs (Defining Aliases for a User Catalog)
- z/OS Basic Skills Information Center: z/OS system installation and management