An IBM Perspective on Servicing & Managing the HFS Environment

Session U06

OS/390 EXPO AND PERFORMANCE CONFERENCE

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Abstract

OS/390 UNIX System Services is the new name for OpenEdition/MVS.   UNIX Services stores data in the hierarchical file system (HFS).   As an MVS System Programmer, you may ask yourself,

- What am I suppose to do with these?
- How do these HFS volumes get cloned?
- How does service get installed with SMP/E?
- How are they kept synchronized with the MVS target libraries?
- How does it all get rolled into a production environment together, synchronized?

If you are seeking answers to these questions, then come to this presentation. Bette Brody presents an IBM perspective.

Assumptions

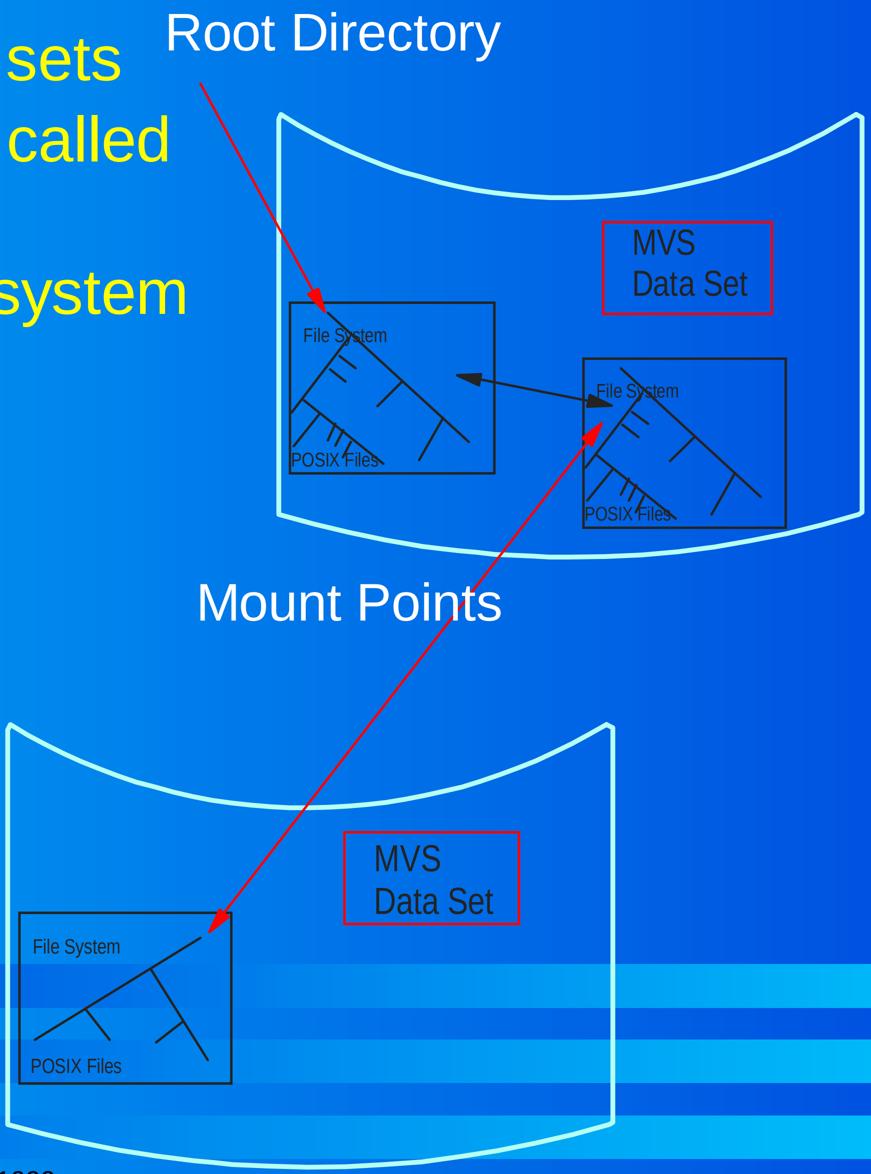
- **UNIX System Services environment is established**
  - Full function UNIX System Services is required beginning with OS/390 2.5 for eNetwork Communications Server, where IP is started.
- **The OMVS address space is started**
  - automatic starting with OS/390 R3
- **An OS/390 maintenance environment is established**

Terminology

UNIX Term	OS/390 Equivalent
Mount Point	Catalog Alias (sorta)
File System	MVS HFS Data Set
SMS Managed HFS	SYSRES Target Data Set

UNIX File System

- **The entire file system is a single tree structure**
  - Single root directory
  - Can be made up of multiple data sets
  - Mounted at arbitrary directories - called mount points
  - SMP/E supports hierarchical file system



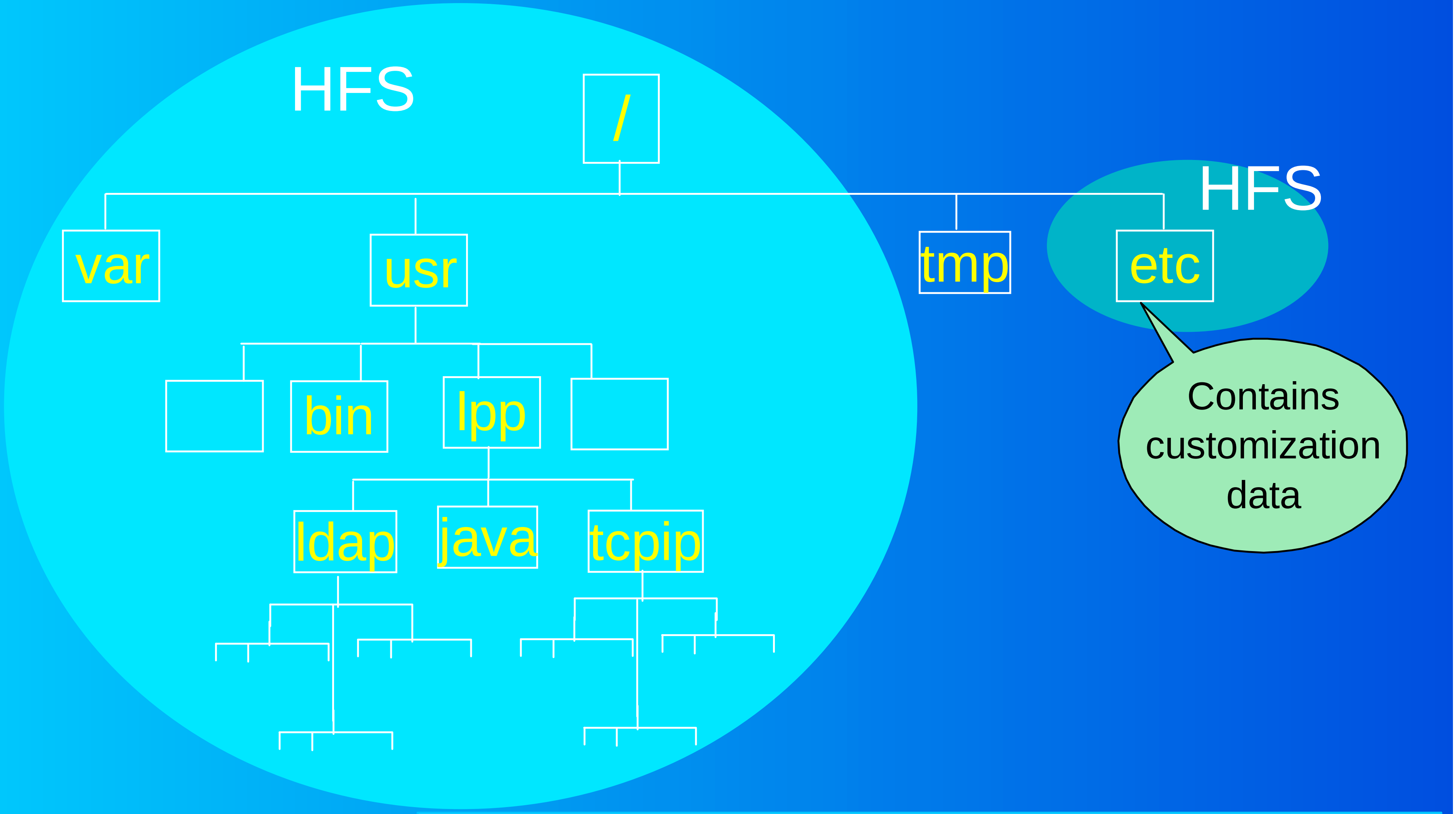
- **Root File System**
  - Small
  - Unique by MVS Image
  - Read/Write (not sharable)
  - Primary Directories
    - /bin, /samples, /usr, /etc, /u, /tmp, /service
  - Directories ONLY - No Files
- **Defined by BPXPRMxx ROOT Statement**

Hierarchical File System Data Set

- **Must be on a volume managed by SMS**
  - ***Changes in OS/390 R8 - December 1999***
- **Allocated like a PDSE using DSNTYPE=HFS**
- **Single volume until OS/390 R7**
  - multi-volume support up to 59 volumes
- **Individual files are limited to 2GB * 59**
  - Up to 123 extents
- **OS/390 UNIX file system can be made up of many HFSs**
- **May be shared (READ only) by multiple systems**
- **File data is always hardened when the file is closed**
- **Can only be opened by the HFS Physical File System**
  - cannot process using standard access methods known to MVS
  - cannot be opened as a PDS although allocated similar to one

```
//DD1 DD DSNTYPE=HFS,
//  DSN=hlq.mlq.ROOT,
//  STORCLAS=ALL,
//  DISP=(,KEEP),
//  SPACE=(CYL,(10,5,1))
```

Hierarchical File System



- ★ ServerPac ships two HFS data sets
  - ➤ ROOT (/)
  - ➤ /etc

System HFS Organization

- IBM ships a root HFS
  - / (root file system) /etc
  - /bin
  - /usr
  - /u

all resident in physical HFS

- Separate HFS for /etc
  - Unique by LPAR (MVS Image)
  - Mounted Read/Write (not shareable)
    - BPXPRMxx MOUNT Statement
- Don’t use SMP/E built /etc directory as actual /etc HFS
  - This would be equivalent to using the SMP/E built SYS1.PARMLIB as your ***primary*** SYS1.PARMLIB.
  - You want to preserve your changes to /etc and /u
    - generally you will add to /etc and /u

Installing Service...

Special Considerations or Differences

- **Only one file hierarchy active at any given time**
  - may have multiple HFS data sets on system
  - not recognized by UNIX unless mounted at a directory (mount point) within the file hierarchy
- **Create a copy of production file system prior to installing service**
  - installing into the production file system will overlay existing modules
  - copy the root file system
    - must be mounted at a directory (mount point) within the active file hierarchy
    - the directories in the newly mounted file system become the target libraries
- **Distribution libraries are still PDSs**

Installing Service

- **Similar to OS/390**
  - Uses a driving system and a target system
- **Driving system is the system used to install service and/or products**
- **Target system is a copy (or clone) of the driving system**
  - SMP/E DDDEFs or DD statements in a catalogued procedure point to the libraries on the target system.
  - Updates are made to this system.
- **Target system becomes the new driving system**

Hierarchical File System Suggestions

- **Develop a naming convention for HFS files**
  - Associate HFS to IPL volume(s), SMP/E environment, or OS/390 release
    - Make use of system symbolics in HFS data set name
      - allows for sharing of BPXPRMxx parmlib member
      - &SYSR1 (resolves to IPL volume serial)
      - &SYSNAME (resolves to system name)
      - &SYSCLONE (resolves to two character name)

- **HFS volume can be considered *"third"* IPL volume in the "IPL Volume Set"**

Hierarchical File System Suggestions

- **One root HFS associated with each SYSRES volume**
  - use volser of SYSRES as a qualifier in the HFS data set name
  - Use system symbolic &SYSR1. *< hlq.&SYSR1..ROOT.llq >*
- **System unique HFS**
  - /etc
  - use system name as a qualifier in the HFS data set name
  - use system symbolic &SYSNAME. *< hlq.&SYSNAME..ETC.llq >*
- **Naming convention for root HFS to be serviced**
  - create a service directory to contain mountpoints for root HFSs to be serviced and customized
    - use /service, /tzonename, or /release_identifier
- **Shared BPXPRMxx parmlib member**
  - use of system symbolics provides the capability to share

Service Considerations

- Read Only HFSs can’t be updated by SMP/E
  - i.e., can’t update "active" System HFSs
- Create "service" HFS Mountpoints
- Need to service the RIGHT set of HFSs
- Need to keep System HFSs in sync with:
  - SYSRES Libraries
  - Target Zone

Service Considerations

- **Mount "service" HFS**
  - mount filesys('CCCHFS.SERVICE') type(hfs) - mode(rdwr) mountpoint('/service')
- **Mount each System HFS**
  - mount filesys('CCCRESE.CCMV1E.BIN') - type(hfs) mode(rdwr) - mountpoint('/SMPE/CCMV1E/bin')
- **Create REXX Execs to mount and unmount**
- **SMP/E DDDEFs contain "service" path:**
  - DDname: SFOMSBIN
  - Path: '/service/usr/lpp/IBM/'
- **ZONEEDIT used when cloning new Target**
  - CHANGE PATH('/SMPE/CCMV1E/'*, '/SMPE/CCMV1A/'*).

BPXPRMxx

```
ROOT FILESYSTEM(’OMVS.&OMVSL..&SYSR1..BASE.HFS’)
  TYPE(HFS) MODE(RDWR)

MOUNT FILESYSTEM(’OMVS.ICSS.LOGS.HFS’)
  TYPE(HFS) MODE(RDWR)
                  MOUNTPOINT(’/usr/lpp/internet/server_root/logs’)

MOUNT FILESYSTEM(’OMVS.CICSWEB.HFS’)
  TYPE(HFS) MODE(RDWR)
                  MOUNTPOINT(’/usr/lpp/internet/server_root/cicsweb’)

MOUNT FILESYSTEM(’OMVS.CICSTS13.PROD.HFS’)
  TYPE(HFS) MODE(RDWR)
                  MOUNTPOINT(’/usr/lpp/cicsts/cicsts13’)

MOUNT FILESYSTEM(’OMVS.&OMVSL..ETC.HFS’)
  TYPE(HFS) MODE(RDWR)      MOUNTPOINT(’/etc’)

MOUNT FILESYSTEM(’OMVS.VAJAVA.HFS’)
  TYPE(HFS) MODE(RDWR)      MOUNTPOINT(’/usr/lpp/hpj’)

MOUNT FILESYSTEM(’/TMP’) TYPE(TFS)         /* temp space at /tmp  */
         MOUNTPOINT(’/tmp’) PARM(’-s 100’)


FILESYSTYPE TYPE(AUTOMNT) ENTRYPOINT(BPXTAMD)
```

BPXPRMxx

data set name to be mounted as root

```
ROOT FILESYSTEM('OMVS.&OMVSL..&SYSR1..BASE.HFS')
  TYPE(HFS) MODE(RDWR)

MOUNT FI          VS.ICSS.LOGS.HFS')
  TYPE(          R)
        M        NT('/usr/lpp/internet/server_root/logs')

MOUNT FILESYSTEM('OMVS.CICSWEB.HFS')
  TYPE(HFS) MODE(RDWR)
        MOUNTPOINT          internet/server_root/cicsweb')

MOUNT FILESYSTEM('O          .PROD.HFS')
  TYPE(HFS) MODE(RDWR)
        MOUNTPOINT('/usr/lpp/cicsts/cicsts13')

MOUNT FILESYSTEM('OMVS.&OMVSL..ETC.HFS')
  TYPE(HFS) MODE(RDWR)      MOUNTPOINT('/etc')

MOUNT FILESYSTEM('OMVS.VAJAVA.HFS')
  TYPE(HFS) MODE(RDWR)      MOUNTPOINT('/usr/lpp/hpj')

MOUNT FILESYSTEM('/TM                 /* temp space at /tmp  */
        MOUNTPOINT('/t         ('-s 100')

FILESYSTYPE TYPE(AUTOMNT) ENTRYPOINT(BPXTAMD)
```

physical file system type

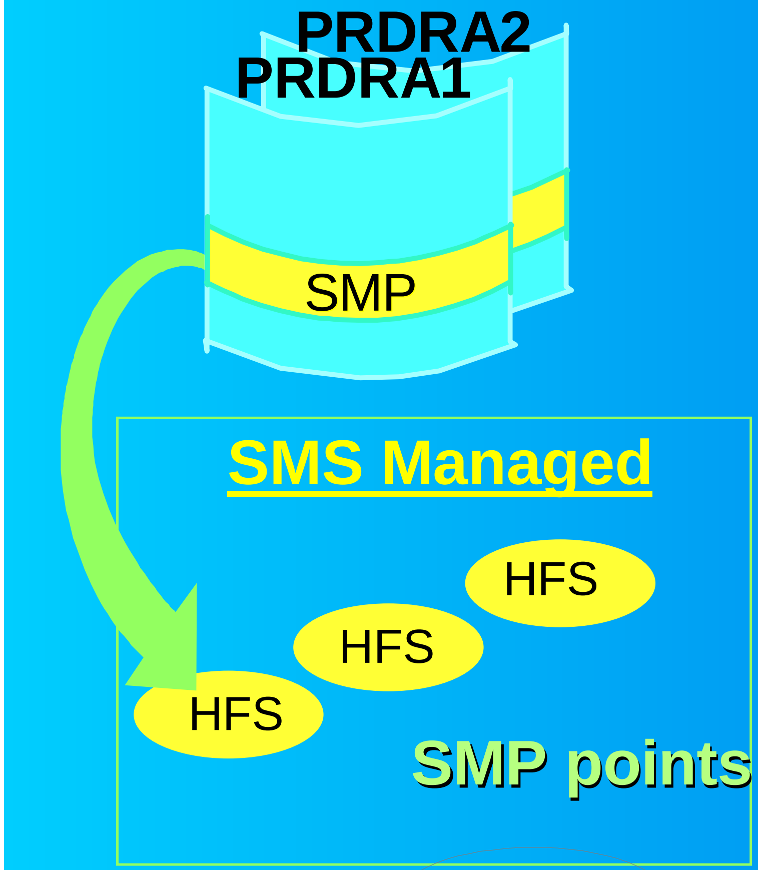
file system to be mounted at initialization

directory where to mount file system

automatic mounting and unmounting

UNIX Services Maintenance

ServerPac



- DDDEF paths are based on root
- Root is specified in BPXPRMxx member
- Mounts specified in BPXPRMxx

SMP points to the path, NOT the HFS data set

Next

Set up separate maintenance environment

Default DDDEF Entry

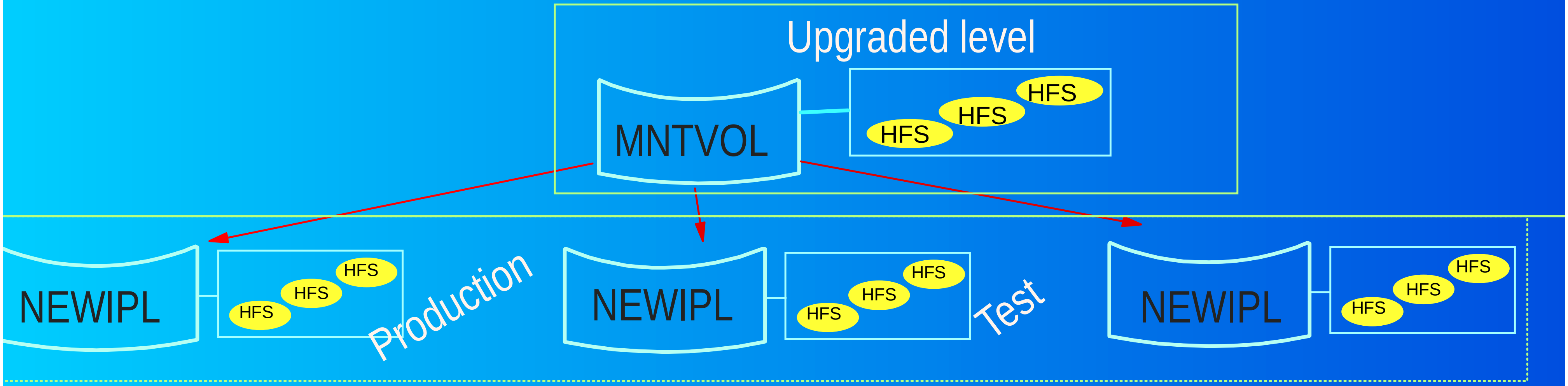
Initial ServerPac DDDEF Entry

```
To return to the previous panel, enter END .

Entry Type:  DDDEF                          Zone Name: OS4T100
Entry Name:  SFSUMCT1                       Zone Type: TARGET
   -----------------------------------------------------------

PATH: '/usr/man/C/cat1/IBM/'
```

Need to change prior to installing service

ServerPac Environment

- **ServerPac installed. Choices need to be made:**
  - Create maintenance environment.
  - MUST Keep maintenance environment and build (clone) from it to create test/production IPL environment(s)



Or

- Maintenance environment becomes new IPL environment
  - Requires creating another maintenance environment from this environment.

UNIX Services Maintenance...

Next

Set up separate maintenance environment

1 → Copy/clone SYSRES
- (production IPL volume)
- Copy SMP/E environment

2 → COPY HFS data sets
- DFDSS or FDR

3 → Update target zone DDDEFs
- target libraries DDDEF (unit and volser)
- DDDEF path names for HFSs

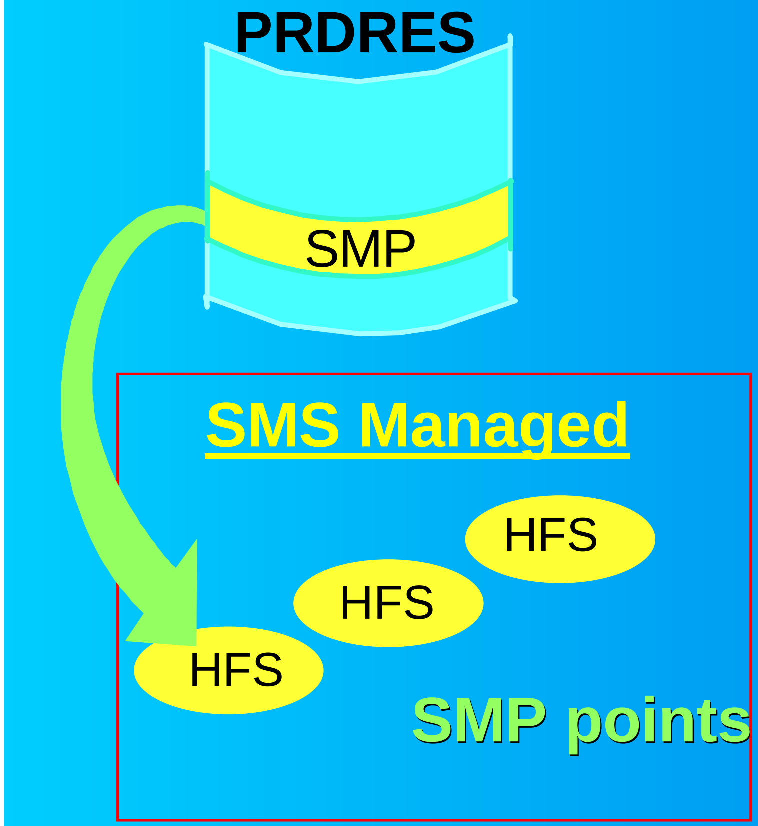
Create Environment

- One and two or three not as simple as it may seem.
  - cloning/copying IPL volumes - easy
  - cloning HFSs - more to it than making copies

- Lets' take a closer look. Next

UNIX Services Maintenance

Production Environment

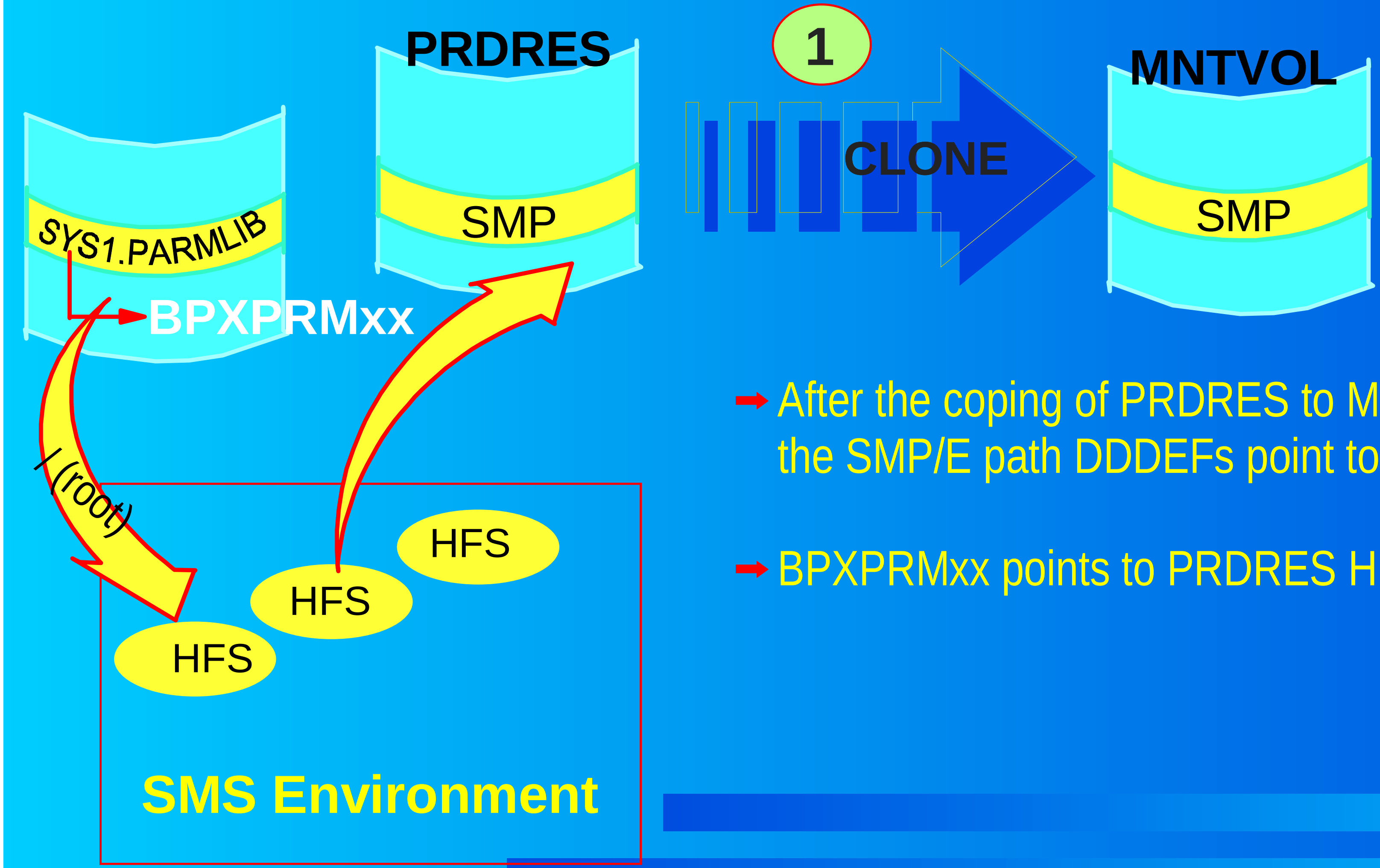


SMP points to the path, NOT the HFS data set

PATH:'/usr/man/C/cat1/IBM/'

UNIX Services Maintenance...

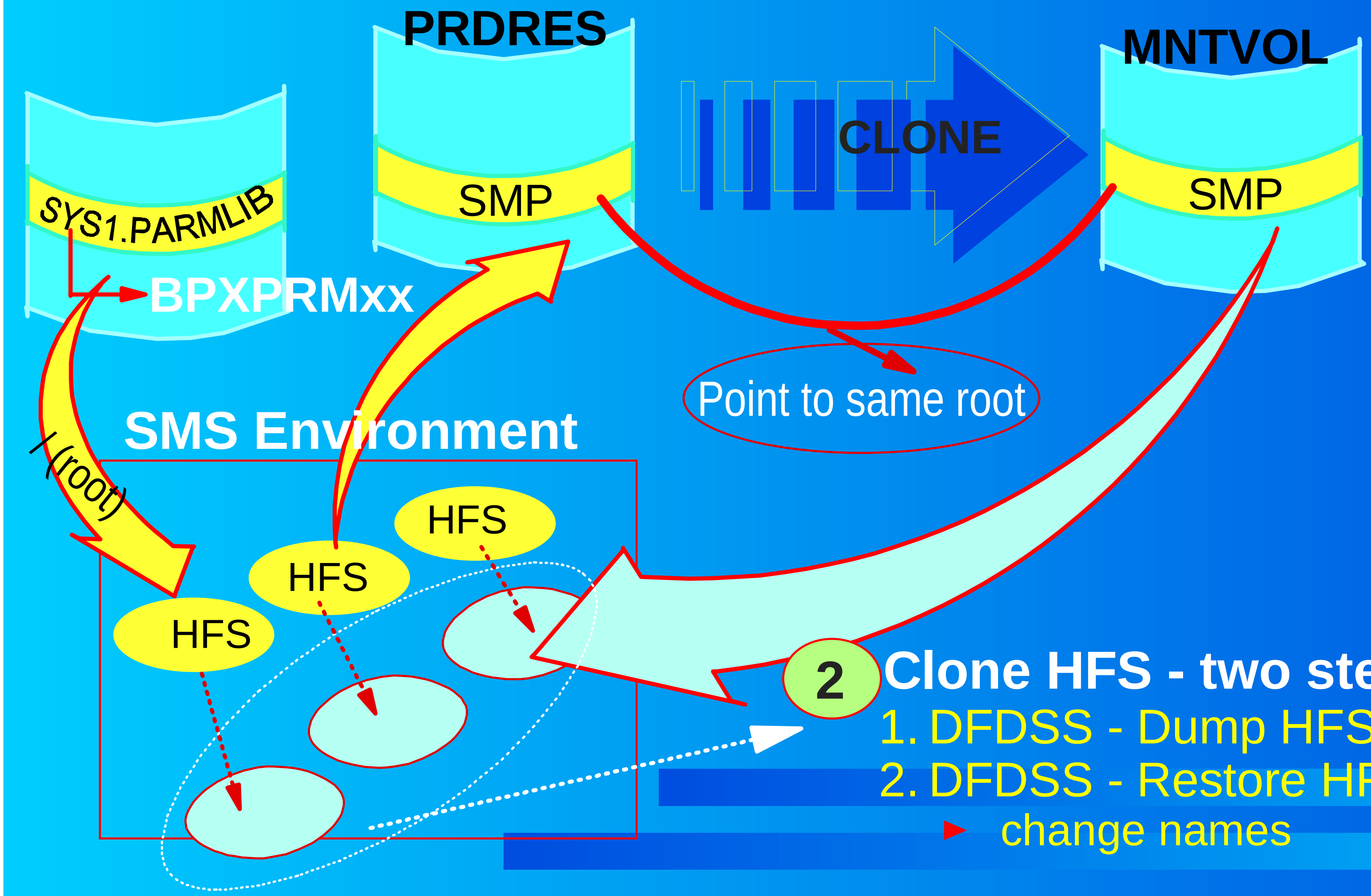
1 Clone Target libraries



- After the coping of PRDRES to MNTVOL, the SMP/E path DDDEFs point to the same root.
- BPXPRMxx points to PRDRES HFS data sets

UNIX Services Maintenance...

2 Clone HFSs



Clone HFS - two step process

1. DFDSS - Dump HFS
2. DFDSS - Restore HFS
   - change names

Next

DFDSS DUMP HFS Sample

```
//DUMPHFS  JOB
//************************************************************
//*
//*  Job to dump serviced root HFS
//*
//*  Replace XXXXXX with SYSRES VOLSER
//*  Replace hlq with the high level qualifier of your HFS
//*    data sets
//*  Replace llq with the low level qualifier of your HFS data sets
//*
//*****************************************************************
//* DUMP ROOT HFS
//*****************************************************************
//DMPROOT  EXEC PGM=ADRDSSU,TIME=60,REGION=4096K
//SYSPRINT DD SYSOUT=*
//SYSABEND DD SYSOUT=*
//DDO      DD DSN=ROOT.XXXXXX.HFSDUMP,DISP=(,CATLG,DELETE),UNIT=3390,
//            SPACE=(TRK,(3500,250)),VOL=SER=XXXXXX
//SYSIN DD *
 DUMP OUTDD(DDO) COMPRESS SHARE OPT(4) -
 DATASET(INCLUDE(hlq.XXXXXX.ROOT.llq)) ALLEXCP ALLDATA(*) TOL(ENQF)
/*
```

DFDSS Restore HFS Sample

```
//RESTHFS  JOB
//********************************************************************
//*  Job to restore serviced root HFS
//*
//*  Replace YYYYYY with VOLSER SYSRES copied to
//*  Replace XXXXXX with VOLSER SYSRES copied from
//*  Replace hlq with the high level qualifier of your HFS data sets
//*  Replace llq with the low level qualifier of your HFS data sets
//*********************************************************************
//* RESTORE NEW ROOT HFS
//*********************************************************************
//RSTROOT  EXEC PGM=ADRDSSU,TIME=60,REGION=4096K
//SYSPRINT DD SYSOUT=*
//SYSABEND DD SYSOUT=*
//DD1      DD DSN=ROOT.YYYYYY.HFSDUMP,DISP=SHR,
//         UNIT=3390,VOL=SER=YYYYYY
//SYSIN    DD *
 RESTORE DATASET(INCLUDE(hlq.XXXXXX.ROOT.llq)) -
      INDD(DD1) -
      TOL(ENQF) -
      STORCLAS(SMSOE) -
      NULLMGMTCLAS -
      RENAMEU(hlq.XXXXXX.ROOT.llq,hlq.YYYYYY.ROOT.llq) -
      REPLACE CATALOG
/*
```

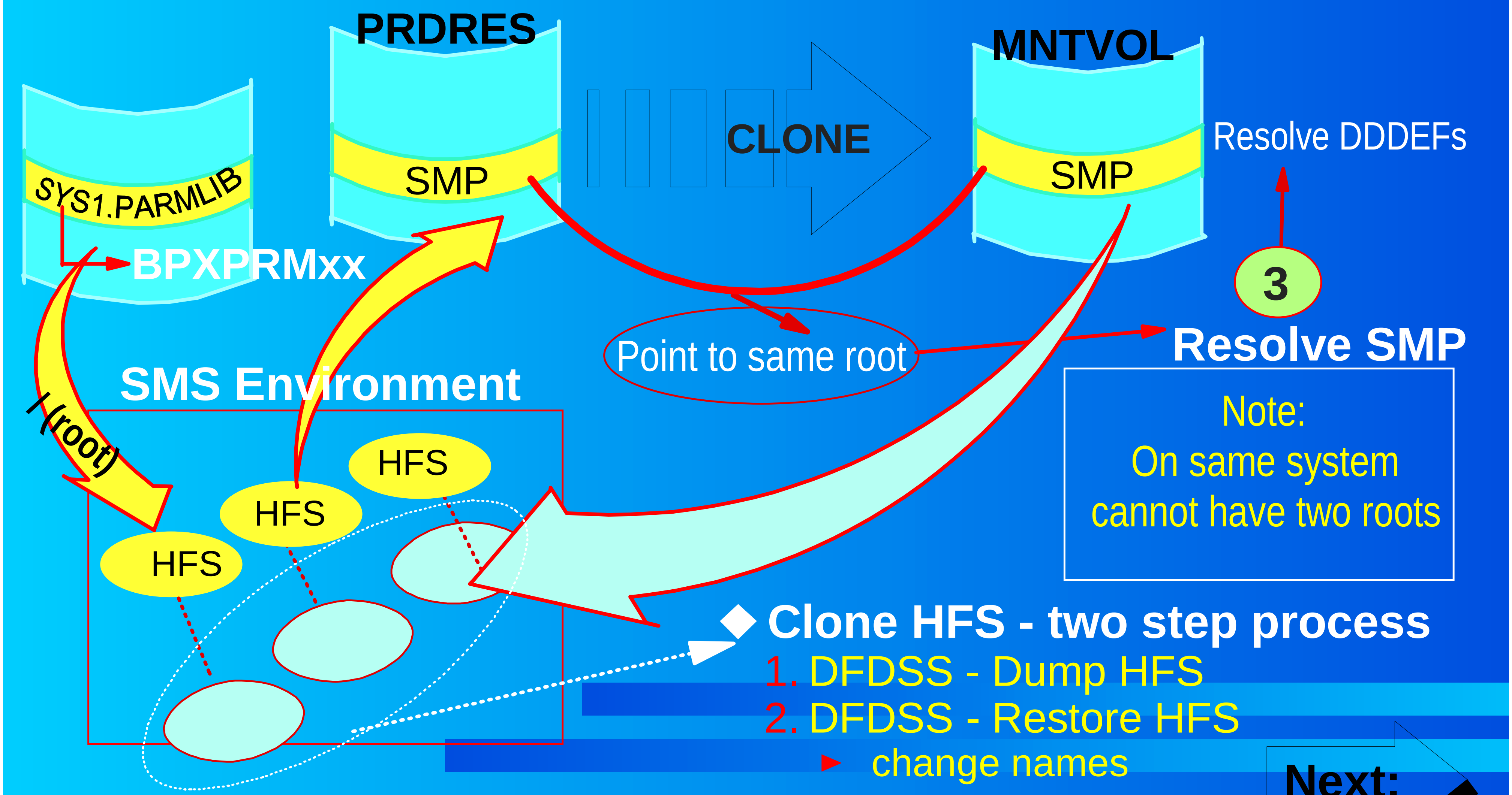
Level Set Through Step 2

- We have two volumes (different volsers) exactly alike
  - PRDRES = MNTVOL
- The SMP/E DDDEFs UNIT, VOLSER & PATH reflect content of PRDRES
- PRDRES has a set of HFS data sets associated with it
- MNTVOL has a set of HFS data sets associated with it
- BPXPRMxx points to PRDRES HFS data sets

Next

UNIX Services Maintenance...

3 Resolve SMP/E



Note:
On same system
cannot have two roots

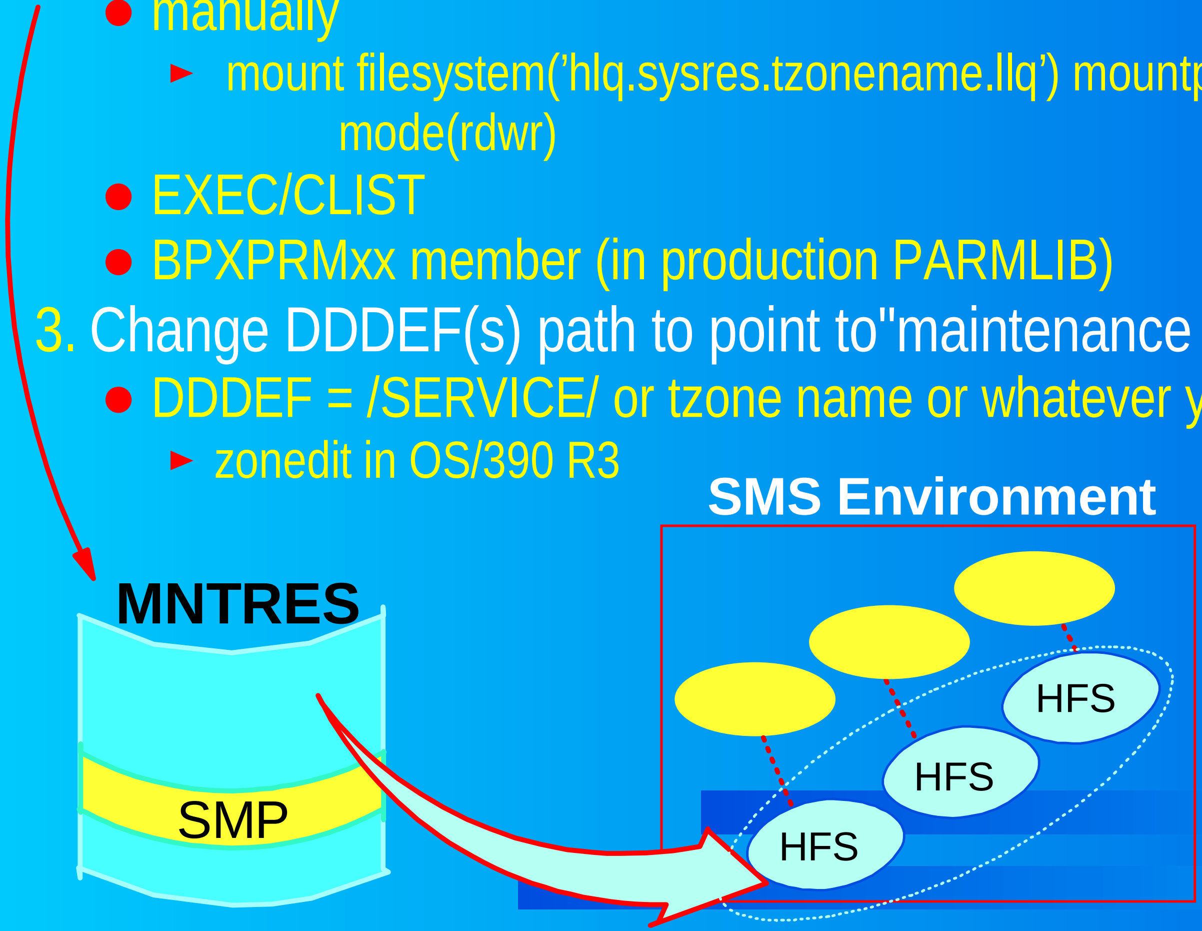
- Clone HFS - two step process
  1. DFDSS - Dump HFS
  2. DFDSS - Restore HFS
     - change names

Next:

UNIX Services Maintenance...

3

1. MKDIR /SERVICE or use name of tzone or whatever you want to call it
   - case sensitive
2. Mount "maintenance set" HFS(s)
   - manually
     - mount filesystem('hlq.sysres.tzonename.llq') mountpoint('/tzonename') type(hfs) mode(rdwr)
   - EXEC/CLIST
   - BPXPRMxx member (in production PARMLIB)
3. Change DDDEF(s) path to point to"maintenance set" HFS(s)
   - DDDEF = /SERVICE/ or tzone name or whatever you want to call it
     - zonedit in OS/390 R3



3

All steps must be completed prior to installing service or products

UNIX Services Maintenance...

ServerPac DDDEF Entry

To return to the previous panel, enter END .

Entry Type: DDDEF   Zone Name: OS4T100
Entry Name: SFSUMCT1   Zone Type: TARGET

PATH: '/usr/man/C/cat1/IBM/'

Recommend: **Adding to DDDEF path another level that is the name of the target zone.**

PATH: '/OS4T100/usr/man/C/cat1/IBM/'

UNIX Services Maintenance...

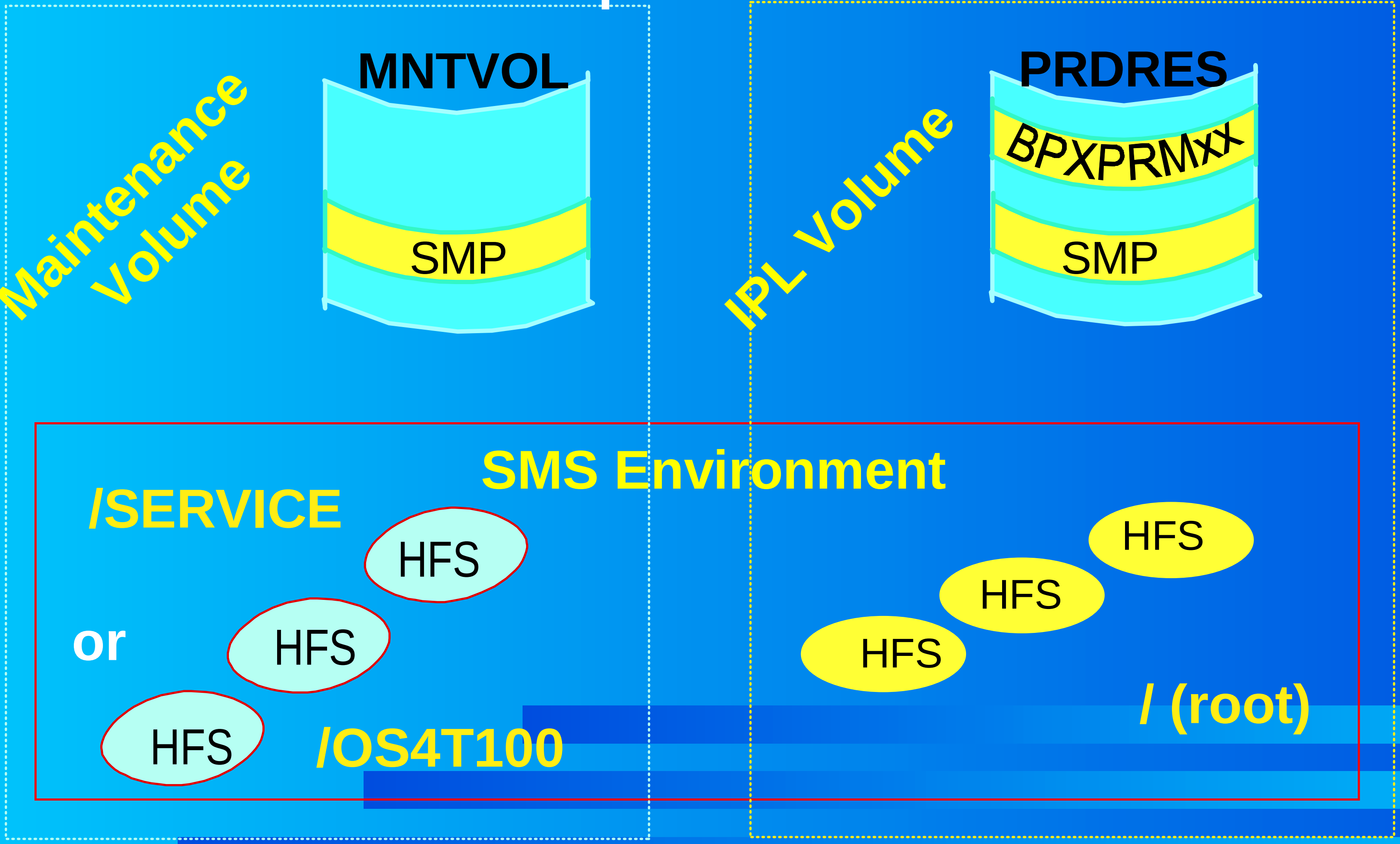
Modified DDDEF Entry

```
To return to the previous panel, enter END .

Entry Type:  DDDEF                         Zone Name: OS4T100
Entry Name:  SFSUMCT1                      Zone Type: TARGET
  -----------------------------------------------------------------

PATH: '/OS4T100/usr/man/C/cat1/IBM/'
```

Remember: it is case sensitive

UNIX Services Maintenance...

End result: Two volumes, same image, accessing the correct path via SMP/E



UNIX Services Maintenance...

Points of Interest

- **Need to be careful of pre/post install jobs for other UNIX Services applications, or service installation**
  - Read all systemholds for any of these conditions
  - Some provide jobs to set the mount, change dddefs, etc.
  - jobs supplied generally will use the root mount point
    - This may not be your service / mount point (i.e. tzone name)
    - Some may use a symbolic in exec which can be modified to point to the /SERVICE mount point
  - symbolic links

Be careful! Remember where SMP/E is pointing to. You can very easily update your production environment.

UNIX Services Maintenance...

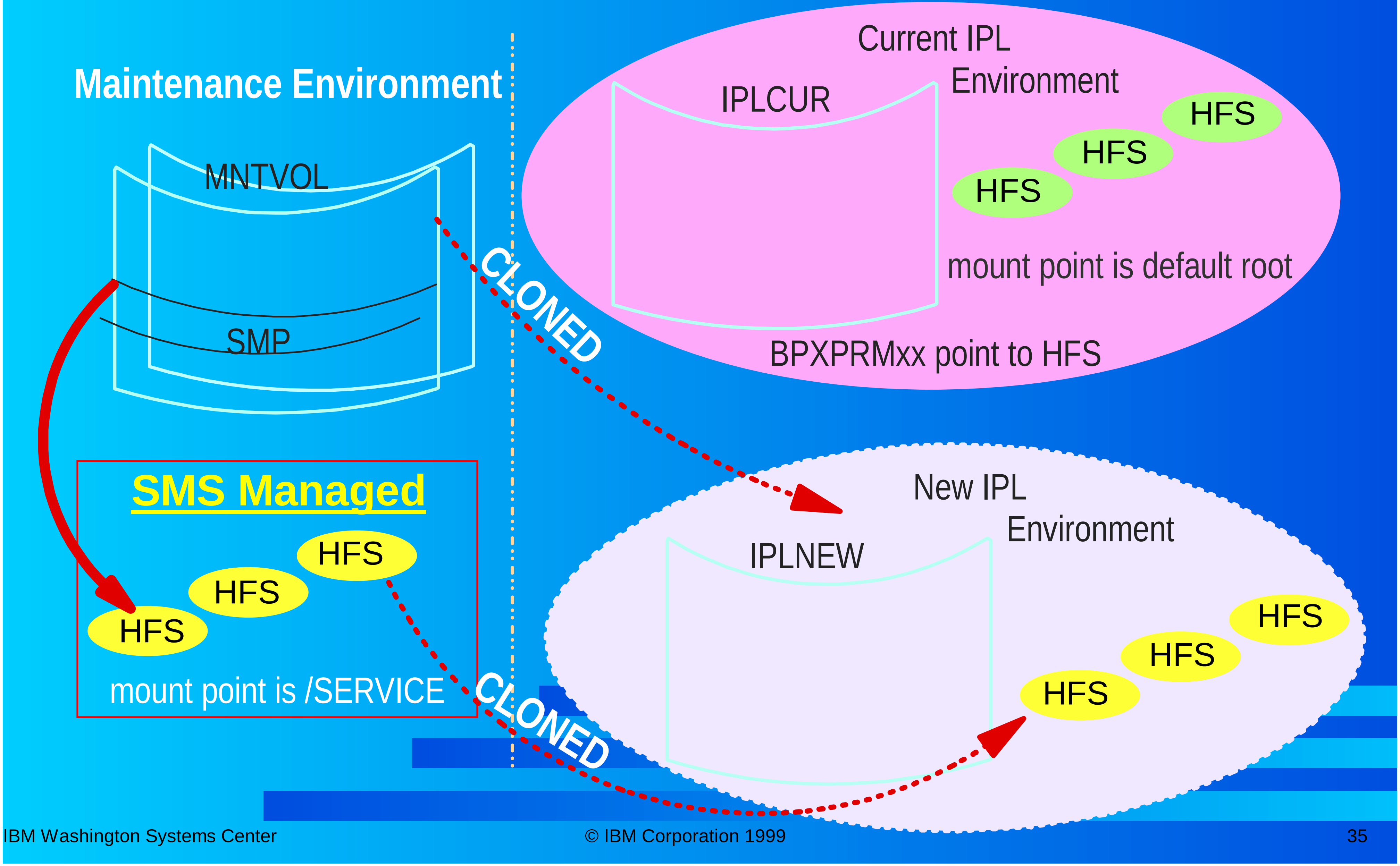
Roll into Production

- Make a new production volume (clone from maintenance volume)
- Make a new set of production HFS(s) from maintenance HFS(s) (new name)
- Correct SMP/E environment for Production clone
  - change DDDEFs to point back to root

Everytime you create a clone, you need to have a new set of HFS(s) data sets with new names.

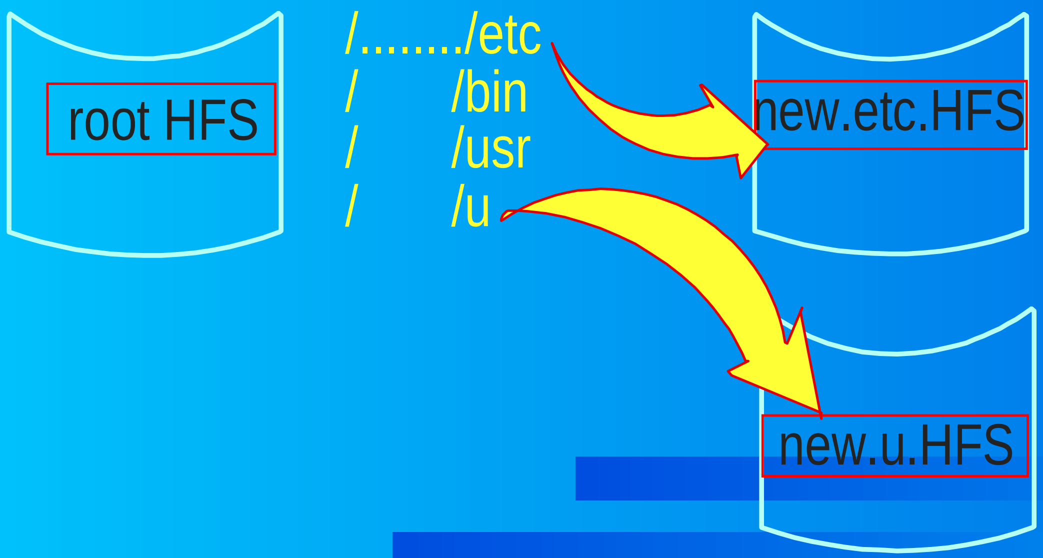
May want to think of a naming convention algorithm.

Environment

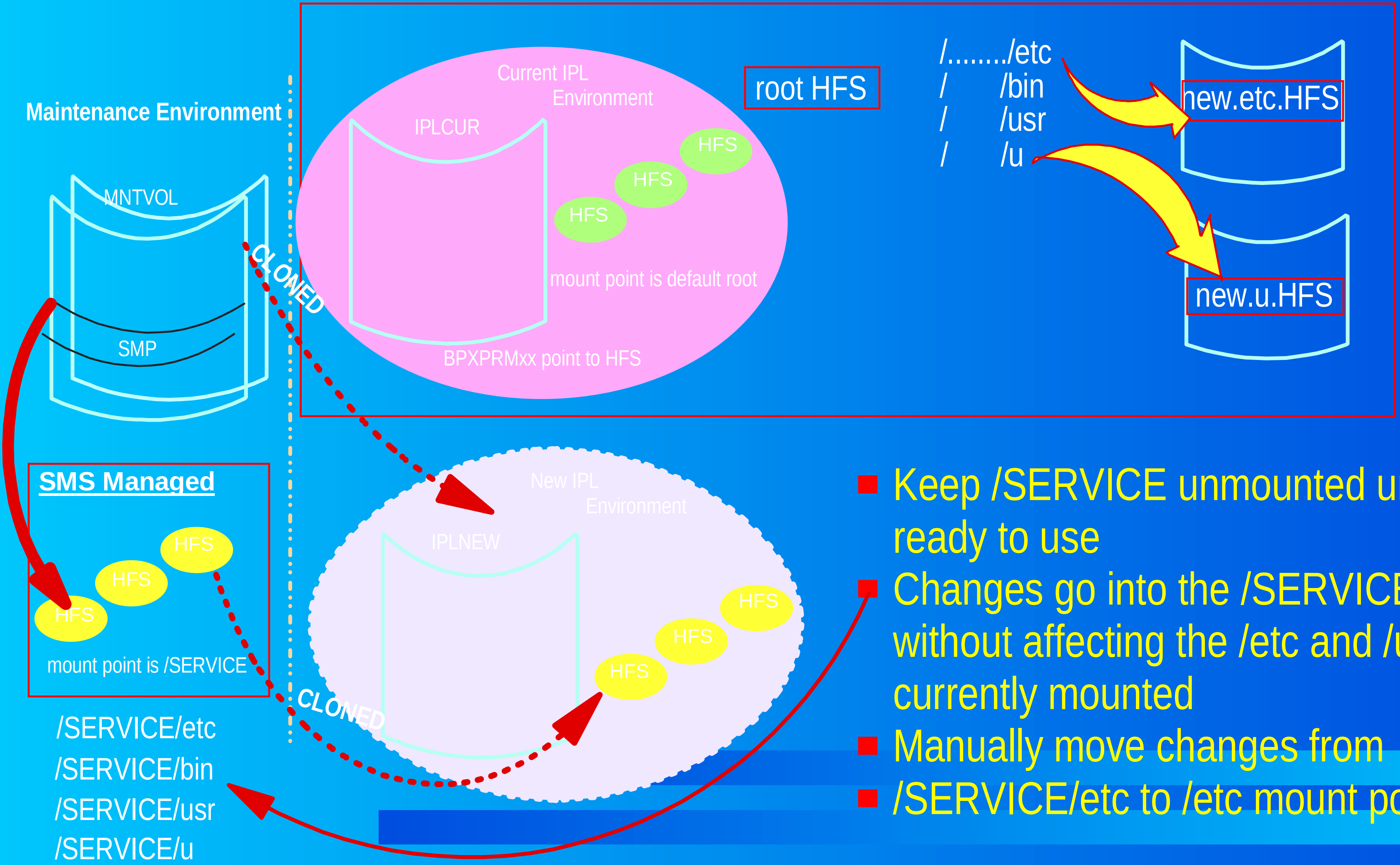


UNIX Services Customization /etc

- **Allocate new HFS**
  - not part of the IBM maintained HFS
  - one for /etc
  - another one for /u
- **Mount these new HFS at the /etc and /u mount point**



UNIX Services Customization /etc



- Keep /SERVICE unmounted until ready to use
- Changes go into the /SERVICE without affecting the /etc and /u currently mounted
- Manually move changes from
- /SERVICE/etc to /etc mount point

Naming Convention Suggestions

- Mount point name of target zone
- common HLQ for HFS data sets
- Use target zone name for second qualifier for maintenance HFS data sets
- Cloning for production - instead of zone name use associated volser for IPL volume
  - this only works if the volser of IPL volume changes when you roll in a new system
    - current IPLVOL -->maint IPLVOL -->new IPLVOL
  - BPXPRMxx member - use &SYSR1 symbolic in HFS data set name, then do not need to change this member
  - will always pick up correct HFS data sets
  - Otherwise must remember to update this member to point to the correct HFS data sets

Gotchas

- POST Installation Command and Execs
  - Many do not support "service" Paths
  - Have to be run against "active" System HFSs
  - HFSs must be Read/Write, so they can’t be shared
- After service, IPL test System with HFSs in Read/Write mode
- Run Commands and Execs
- Remount Read Only (or Re-IPL)

Gotchas

- **New Release Installation Issues**
  - Installation of product replaces physical HFS
  - Releases change Path definitions while using the same DDDEF name
  - Old PATH DDDEFs retired
  - Symbolic Link change
- **Review and update DDDEFs before APPLY**

Summary

- Remember where SMP/E is pointing
- Establish naming convention for HFS data sets
- Ensure BPXPRMxx is pointing to correct HFS data sets
- Document your process
- Backups are a good idea!
  - DFSMShsm will not backup allocated data sets
  - therefore, if maintenance HFS data sets are always allocated you will need to unmount them prior to backing up.
  - May not want to place these in the BPXPRMxx member
    - instead create an exec to mount and unmount as needed