z/OS 2.1
Unix Systems Services
Latest Status and New Features

Trish Nolan

BMC Software, Inc.

Trish_Nolan@bmc.com

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HFS vs. zFS

- IBM introduced zFS filesystems in v1r7
  - Improved performance and data integrity over HFS
  - z/OS v2r1 Migration Guide clearly documents:
    - zFS is the "strategic" filesystem
    - "…you should migrate your HFS file systems to zFS"
    - "…action is planned to become a requirement in a future release"
  - The writing is on the wall…..
  - IBM provides ISPF based tool **BPXWH2Z** for conversion
  - Use IBM Health Checker or USS monitors to identify HFS files to be converted

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Identify HFS Filesystems

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Things To Consider…

- Are you reporting on closed sockets?
  - RMF no longer reports these in record type 92 subtype 11
    - Socket/special file close records now in type 92 subtype 16
    - Include type 92 subtype 16 in SMFPRMxx member
      - **SYS(TYPE(92(16)),...)**

- RMF III zFS monitoring default has changed
  - Default is now NOZFS (will not collect zFS activity data)
    - Update default in RMF III parmlib member ERBRMF04
      - *Change NOZFS to ZFS*
      - *Dynamic change: MODIFY RMF,MODIFY III,ZFS*

Things To Consider…

- **BPX.DEFAULT.USER** security profile has been removed
  - Users could previously access USS without an assigned UID or GID
    - Users were assigned a default UID/GID for life of session
    - Multiple users could share the same default UID/GID
    - Not enough granularity!
- **BPX.UNIQUE.USER** replaces **BPX.DEFAULT.USER**
  - Users are assigned a unique UID/GID automatically
  - RACF must be at AIM Stage 3 level
    - Run IRRIRA00 utility to convert to AIM Stage 3
- Check RACF **FACILTY** class for BPX.DEFAULT.USER
- Both profiles can "coexist" (great for testing)
  - BPX.UNIQUE.USER will override BPX.DEFAULT.USER

TFS Enhancements

- **-fsfull** parameter is now supported for TFS
  - mount parm indicates when to begin/reissue/remove warnings (BPXTF009E)
    - parm('FSFULL(70,10)')
  - Message will be issued when 100% full regardless of **-fsfull**
  - Can be coded in BPXPRMnn on PARM statement
  - **-ea** parm allows the file system to *automatically* grow x number of times
  - **-em** parm allows the file system to *manually* grow x number of times
- Example of BPXPRMnn statement:
  - **FILESYSTYPE TYPE(TFS) ENTRYPOINT(BPXTFS) ASNAME(TFSPROC,'SUB=MSTR') PARM('-fsfull(70,10) -ea 50 -em 10')**

TFS Enhancements (cont'd)

- **-**TFS grows in 1K blocks each time it grows
  - With default 4K blocksize, TFS grows 4M each time
- The SUM of **–ea** and **–em** values cannot exceed 500
- **-ea** and **–em** values can be changed dynamically
  - F tfs,EA *number*
  - F tfs,EM *number*
- Issue **f tfs,q** to list default tfs settings

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-fsfull Parameter

File System Name	FS Type	SSI System	FS Sts		%Utilization 0 100	Mount Point	Mount Parms	Owner System	Auto Movable	Quiesce System	Client
USS.BMCA.SHRD.ZFS	ZFS	BMCA	Act	0.52		/shrd		BMCA	No		No
BMCSCM.ISR.BMCISRFS	ZFS	BMCB	Act	10.68		/shrd/BMCSCM/bmc/bmr/v15	FSFULL(75,5)	BMCB	No		No
CSGI.WAGA.CONFIG	HFS	BMCA	Act	17.48		/SYSTEM/var/waga/config/bmca7bs/		BMCA	No		No
CSGI.WBGA.CONFIG	HFS	BMCB	Act	17.28		/SYSTEM/var/wbga/config/wbgabs/w		BMCA	No		No
CSGI.WAGM.CONFIG	HFS	BMCA	Act	24.22		/SYSTEM/var/wagm/config		BMCA	No		No
CSGI.WBGM.CONFIG	HFS	BMCB	Act	27.68		/SYSTEM/var/wbgm/config		BMCB	No		No
BMCSCM.ZSCA.CASRGRY	ZFS	BMCA	Act	22.25		/shrd/BMCSCM/MAINVIEW	FSFULL(75,5)	BMCA	No		No
BMCSCM.ZSCB.CASRGRY	ZFS	BMCB	Act	5.07		/shrd/BMCSCM/MAINVIEW	FSFULL(75,5)	BMCB	No		No
/tmp	TFS	BMCB	Act	0.88		/SYSTEM/tmp	-s 50	BMCB	No		No
/tmp	TFS	BMCA	Act	0.80		/SYSTEM/tmp	-s 50	BMCA	No		No
BMCSCM.BMM.BMCB.ZFS	ZFS	BMCB	Act	54.41		/shrd/BMCSCM/BMM	FSFULL(75,5)	BMCB	No		No
USS.BMCB.SHRD.ZFS	ZFS	BMCB	Act	1.61		/shrd		BMCB	No		No
USS.BMCB.LOCAL	ZFS	BMCB	Act	1.16		/shrd/local		BMCB	No		No
BMCSCM.TGT1401B.MVWHFS	ZFS	BMCB	Act	20.54		/shrd/BMCSCM/bmc/mvw/v32	FSFULL(75,5)	BMCB	No		No
BMCSCM.TGT1401B.BDRHFS	ZFS	BMCB	Act	2.76		/shrd/BMCSCM/bmc/bdr/v65	FSFULL(75,5)	BMCB	No		No
BMCSCM.BMCB.UFOHFS	ZFS	BMCB	Act	1.39		/shrd/BMCSCM/bmc/ufo	FSFULL(75,5)	BMCB	No		No
USS.BMCA.SERVER.LOGS	ZFS	BMCA	Act	1.40		/usr/lpp/internet/server_root/lo		BMCA	No		No
BMCSCD.RTE101.BMCLGCFS	ZFS	BMCA	Act	5.40		/shrd/BMCSCD/var/bmc/lgc/v00	FSFULL(75,5)	BMCA	No		No
USS.BMCA.VAR	ZFS	BMCA	Act	10.07		/SYSTEM/var		BMCA	No		No
/dev	TFS	BMCA	Act	5.47		/SYSTEM/dev	-s 1	BMCA	No		No
/dev	TFS	BMCB	Act	5.47		/SYSTEM/dev	-s 1	BMCB	No		No
USS.BMCA.ETC	ZFS	BMCA	Act	70.44		/SYSTEM/etc		BMCA	No		No
USS.BMCB.ETC	ZFS	BMCB	Act	62.73		/SYSTEM/etc		BMCB	No		No
USS.BMCB.VAR	ZFS	BMCB	Act	79.29		/SYSTEM/var		BMCB	No		No
CSGI.WAGA.SBBOHFS	HFS	BMCA	Act	89.22		/SYSTEM/var/waga/smpe		BMCA	No		No
CSGI.WBGA.SBBOHFS	HFS	BMCB	Act	89.22		/SYSTEM/var/wbga/smpe		BMCB	No		No
USS.DEMO.ROOT.ZOS113.D140722	ZFS	BMCA	Act	99.21		/		BMCA	No		No
USS.DEMO.ROOT.ZOS113.D140722	ZFS	BMCB	Act	99.21		/		BMCB	No		No
CSGI.WAGM.SBBOHFS	HFS	BMCA	Act	83.36		/SYSTEM/var/wagm/smpe		BMCA	No		No
CSGI.WBGM.SBBOHFS	HFS	BMCB	Act	83.36		/SYSTEM/var/wbgm/smpe		BMCB	No		No
USS.WMQ.ZFS	ZFS	BMCA	Act	41.31		/usr/lpp/mqm		BMCA	No		No
USS.WMQ.ZFS	ZFS	BMCB	Act	41.31		/usr/lpp/mqm		BMCB	No		No
USS.CICSTS.PROD	HFS	BMCA	Act	54.77		/shrd/cics		BMCA	No		No
USS.CICSTS.PROD	HFS	BMCB	Act	54.77		/shrd/cics		BMCB	No		No
USS.BMCX.JAVA64V6	ZFS	BMCB	Act	97.08		/shrd/java/J6.0.1_64		BMCB	No		No
USS.BMCX.JAVA31V6	ZFS	BMCB	Act	96.59		/shrd/java/J6.0.1		BMCB	No		No
USS.IMS.PROD	HFS	BMCA	Act	99.77		/shrd/ims		BMCA	No		No
USS.IMS.PROD	HFS	BMCB	Act	99.77		/shrd/ims		BMCB	No		No
USS.BMCX.JAVA31V5	ZFS	BMCB	Act	95.67		/shrd/java/J5.0		BMCB	No		No
USS.BMCX.JAVA64V5	ZFS	BMCB	Act	95.59		/shrd/java/J5.0_64		BMCB	No		No
BMCSCM.CBX1401B.MVWHFS	ZFS	BMCA	Act	20.54		/shrd/BMCSCM/VASFS		BMCA	No		No

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Enhancements to AUTOMOUNT

- Last use information now available for automounted file systems
  - **automount –f *FileSystemName***
  - Filesystem name must be included (case insensitive)
    - All matching automounted filesystems reported
  - Results display:
    - File system name, mount point, state, timer, UID, PID, jobname
- New **pathperm** keyword on allocany/allocuser
  - Specifies the root permissions for new file system
  - May only be used on zFS
    - All systems in a shared file system must be at zOS v2r1
  - Default is 750 (if value 000 default is used)
  - Use **automount –q** command to display value for allocany/allocuser

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Enhancements to AUTOMOUNT (cont'd)

- New **EUID** parameter on ALLOCUSER/ALLOCANY keyword
  - Process owner UID/GID used by default
  - With **EUID** specified UID/GID of thread is used

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MAXPIPEUSER

- New BPXPRMnn parameter
- MAXPIPEUSER specifies the maximum number of named and unnamed pipes a <u>single UID</u> can have open/use concurrently
  - UID(0) automatically set to 8730
- Use D OMVS, PIPES to display top users:

```
BPXO073I 09.21.55 DISPLAY OMVS 099
OMVS     0010 ACTIVE          OMVS=(01,F1,F9)
PIPE OWNER SUMMARY       MAXPIPEUSER=8730
NO PIPES CURRENTLY IN USE
HIGHWATER USER:
   USERID=CFZADM UID=9001 HIGHWATER USAGE=2
```

- Maximum number of <u>system</u> pipes increased from 8730 to 15K

MAXUSERMOUNTSYS

- New BPXPRMnn parameter
- Specifies the maximum number of *nonprivileged* (UID not 0) user mounts in the <u>system</u>
- If you want to use nonprivileged user mounts this parameter must be set to a value > 0
- Can be altered dynamically with SETOMVS command

MAXUSERMOUNTUSER

- New BPXPRMnn parameter
- Specifies the maximum number of *nonprivileged* (UID not 0) user mounts allowed for each nonprivileged user.
- If you want to use nonprivileged user mounts this parameter must be set to a value > 0
- Can be altered dynamically with SETOMVS command

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MAXIOBUFUSER

- Limits each users (UID) I/O buffers in kernel storage in a Unicode (AUTOCVT) conversion environment
- Size specified in MB
  - 0 – 2PB
  - *Although storage is above 2G bar, excessive use can cause siginificant storage and paging storage to be utilized below bar*
- Storage remains allocated as long as file is open
- Amount of storage allocated depends on:
  - CCSID
  - Size of read/write request used by process
- If file inherited by different UID – amount is not propogated
  - When UID changes through spawn or exec

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Display BPXPRMnn Limits/Utilization

D OMVS,LIMITS

BPXO051I 14.41.59 DISPLAY OMVS 939

OMVS   0010 ACTIVE   OMVS=(01,F1,F9)

SYSTEM WIDE LIMITS: LIMMSG=NONE

	CURRENT USAGE	HIGHWATER USAGE	SYSTEM LIMIT
MAXPROCSYS	189	203	4096 *
MAXUIDS	1	2	200
MAXPTYS	0	0	256
…			
MAXUSERMOUNTSYS	0	0	0
MAXUSERMOUNTUSER	0	0	0
MAXPIPES	0	16	15360

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Display BPXPRM Limits/Utilization

C	BPXPRM Element	MOD	MAXIMUM	CURRENT	CURR %	High Water	Exceeds
	IPCMSGNIDS	-	500	30	6.0	30	0
	IPCMSGQBYTES	-	262144			12	
	IPCMSGQMNUM	-	10000			1	
	IPCSEMNIDS	-	500	6	1.2	6	0
	IPCSEMNOPS	-	25				
	IPCSEMNSEMS	-	32				
	IPCSHMMPAGES	-	4096			4096	
	IPCSHMNIDS	-	500	6	1.2	6	0
	IPCSHMNSEGS	-	10				0
	IPCSHMSPAGES	-	262144	0	0.0	0	0
	MAXASSIZE	-	2147483647				
	MAXCORESIZE	-	16777216				
	MAXCPUTIME	-	5000				
	MAXFILEPROC	-	64000	0	0.0		
	MAXFILESIZE	-	2147483647				
★	MAXIOBUFUSER	-	2048				
	MAXMMAPAREA	-	4096	646	15.8	646	0
★	MAXPIPES	-	15360	57	0.4	61	
★	MAXPIPEUSER	-	8730				
	MAXPROCSYS	-	6000	1036	17.3	1037	0

C	BPXPRM Element	MOD	MAXIMUM	CURRENT	CURR %	High Water	Exceeds
	MAXPROCUSER	-	500	0	0.0		0
	MAXPTYS	-	256	0	0.0	1	
	MAXQUEUEDSIGS	-	1000				0
	MAXSHAREPAGES	-	250000	1048	0.4	1048	0
	MAXTHREADS	-	750				0
	MAXTHREADTASKS	-	750				
	MAXUIDS	-	200	10	5.0	11	0
★	MAXUSERMOUNTSYS	-	0	0	0.0	0	
★	MAXUSERMOUNTUSER	-	0	0	0.0	0	
	SHRLIBMAXPAGES	-	4096	0	0.0	0	
	SHRLIBRGNSIZE	-	67108864	67108864	100.0	67108864	110
	SOC/AF_INET	-	64000	858	1.3	863	
	SOC/AF_UNIX	-	10000	204	2.0	212	

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PWT Statement

- New BPXPRMnn statement
- Indicates whether processes waiting on terminal input should be timed-out
- Works in conjunction with SMFPRMnn JWT/SWT/TWT parameters
    - PWT(SMF/ENV/SMFENV)
        - SMF – uses **JWT/SWT/TWT** values in SMFPRMnn, all waiting processes will time-out, **_BPXK_TIMEOUT** is ignored
        - SMFENV – processes will be timed out according to SMFPRMnn, allows processes with **_BPXK_TIMEOUT** to override SMFPRMnn
        - ENV – allows **_BPXK_TIMEOUT** value to override SMFPRMnn values, only those processes with this environment variable will time-out

    - To force time-out for all processes, set PWT to SMF
    - **_BPXK_TIMEOUT** environment variable (/etc/profile) ignored when PWT(SMF)
    - **_BPXK_TIMEOUT** environment variable honored when PWT(ENV) or PWT(SMFENV)

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AUTOCVT

- As we become more "globally aware"…Unicode becomes a requirement

- Unicode provides a unique number for every character, regardless of platform, language, or program

- Software can be developed to work across multiple platforms, languages and countries

- AUTOCVT allows text conversion to take place automatically when any USS thread reads/writes a "tagged" file

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AUTOCVT (cont'd)

- In BPXPRMnn:
  - Activates/deactivates automatic Unicode code conversion for all I/O using coded character sets
  - Files that are "tagged" can be converted between any CCSID of the program/user and the CCSID of the file.
    - CCSID: Coded Character Set ID
    - 01200 is most recent CCSID supported (UTF-16 encoded)
  - CCSIDs are set by program or environment variables at run time
  - SETOMVS or SET OMVS commands can be used to toggle AUTOCVT on/off
    - Will not affect any open files with I/O in progress
  - AUTOCVT(ON) checks *every* read/write for a "tagged" file to determine if conversion is required

AUTOCVT (cont'd)

- Performance overhead affected when AUTOCVT(ON)
  - Keep AUTOCVT(OFF) if possible
  - Use compile/run time variables to control
    - Control with BPXYTHLI thread level information macro
      - THLICVTON/THLICVTOFF
    - Control with _BPXK_AUTOCVT environment variable

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zFS Aggregates & Clones

- zFS multi-file system aggregates and clones are no longer supported in v2r1
- Copy the these files to zFS compatibility mode aggregates
- The following zfsadm commands are no longer supported:
  - clone
  - clonesys
  - create
  - lsquota
  - rename
  - setquota

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zFS Aggregates & Clones (cont'd)

- Use the following methods to identify zFS multi-file system aggregates:
  - IBM Health Checker
  - Scan /etc/rc file for **zfsadm attach** commands
  - Issue **zfsadm aggrinfo** command
    - MULT in zfsadm response indicates multi-file system aggregate
  - USS monitor

zFS Aggregates & Clones (cont'd)

- ## Output from zfsadm aggrinfo:
    IOEZ00370I A total of 9 aggregates are attached.
    USS.BMCA.SERVER.LOGS (R/W **COMP**): 14198 K free out of total 14400
    BMCSCD.RTE101.BMCLGCFS (R/W **COMP**): 6811 K free out of total 7200
    BMCSCM.CPY1401B.MVWHFS (R/O **COMP**): 12015 K free out of total 15120
    USS.WMQ.ZFS (R/O **COMP**): 851879 K free out of total 1451520
    USS.BMCA.ETC (R/W **COMP**): 298 K free out of total 1008
    USS.BMCA.VAR (R/W **COMP**): 5741 K free out of total 6384
    USS.DEMO.ROOT.ZOS113.D140722 (R/O **COMP**): 18383 K free out of total 2335360
    BMCSCM.ZSCA.CASRGRY (R/W **COMP**): 59937 K free out of total 77040
    USS.BMCA.SHRD.ZFS (R/W **COMP**): 2657374 K free out of total 2671200

- ## USS monitor output:

zFS Aggregate Name	Aggregate ID	File Systems	Type	
BMCSCD.RTE101.BMCLGCFS	9	1	COMP	
BMCSCM.CPY1401B.MVWHFS	7	1	COMP	
BMCSCM.ZSCA.CASRGRY	8	1	COMP	
USS.BMCA.ETC	2	1	COMP	
USS.BMCA.SERVER.LOGS	5	1	COMP	
USS.BMCA.SHRD.ZFS	4	1	COMP	
USS.BMCA.VAR	3	1	COMP	
USS.DEMO.ROOT.ZOS113.D140722	1	1	COMP	
USS.WMQ.ZFS	6	1	COMP	

Reference Material

- Migration from z/OS V1R13 and z/OS V1R12 to z/OS V2R1 (GA32-0889-00)
- z/OS UNIX System Services Planning (GA32-0884-00)
- z/OS UNIX System Services User's Guide (SA23-2279-00)
- Unix System Services Command Reference (SA23-2280-00)

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