

New Introduction for **JES2 System Programmers**

Session # 2661

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John Hutchinson, presented by Chip Wood

IBM Washington Systems Center

hutchjm@us.ibm.com



What you need to know to be a good JES2 Systems Programmer?



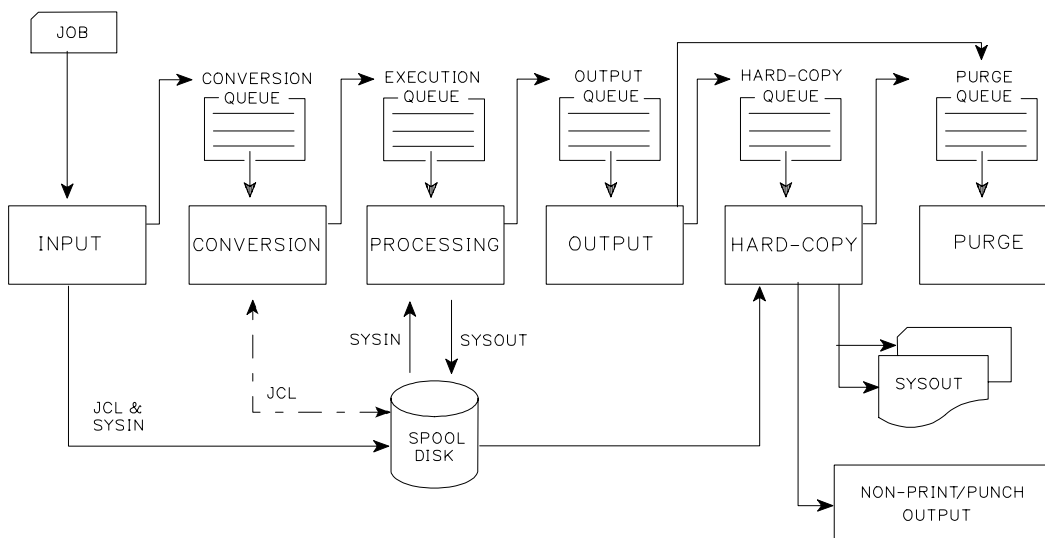
- **How your company uses JES2.**
 - ▶ Understand how JES2 supports it
 - ▶ Configuration options
- **How to keep JES2 alive and healthy.**
 - ▶ Customized for your environment
 - ▶ Available & Secure
 - ▶ Well Managed
 - ▶ Up-to-date, Maintained, & Well Tested
 - ▶ Performing like a Top
- **References** (where to turn for help)

Why do you need JES, anyway?



- **Enter Jobs, TSO Users, Started Tasks**
 - ▶ From local & remote readers, other NJE nodes, offload, internal (programmable) readers
 - ▶ Provide temporary storage for I/O files (Spool)
- **Schedule Batch Job Execution**
 - ▶ Manage (queue) jobs before and after execution
 - ▶ Balance Work between multiple Systems & Nodes
- **Distribute Output**
 - ▶ Printers, punches, remotes, NJE nodes, offload, and Programmable interfaces (PSO, SAPI)
- **History ...**
 - ▶ Efficiently manage system resources

Phases of Job Processing



Each queue is input to specific JES2 processors
(represented by PCEs - Process Control Elements)

JES2 Queuing Mechanisms



■ Job Queuing & Selection

- ▶ 38 Execution Class Queues (A-Z, 0-9, STC, TSU)
 - Ordered FIFO within Priority (may be Priority Aged - optional)
- ▶ Jobs (JQEs) Selected First-come-First-served by Job Queue PCEs (CNVTs, XEQs, HOPEs, XMITs, PURGs) across the MAS
 - Using \$QGET, Work-Select Tables, Exit 49/14, ...

■ Output Queuing & Selection

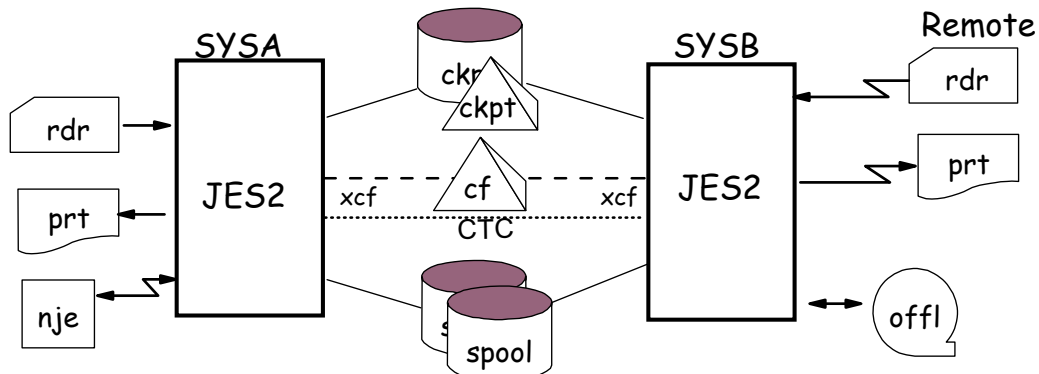
- ▶ 110 Output Qs (Hold, NJE, 36 local (A-Z, 0-9), 36 Rmt, 36 Usr)
 - Ordered FIFO within Prty within User/DestID (may be Priority Aged)
- ▶ Output Elements (JOEs) selected First-come-First-served by Output Queue PCEs (PRTs, PUNs, XMITs, FSSs) across MAS
 - Using \$#GET, PSO, SAPI, WS Tables (no Exits)

JES2 Multi-Access Spool (MAS)

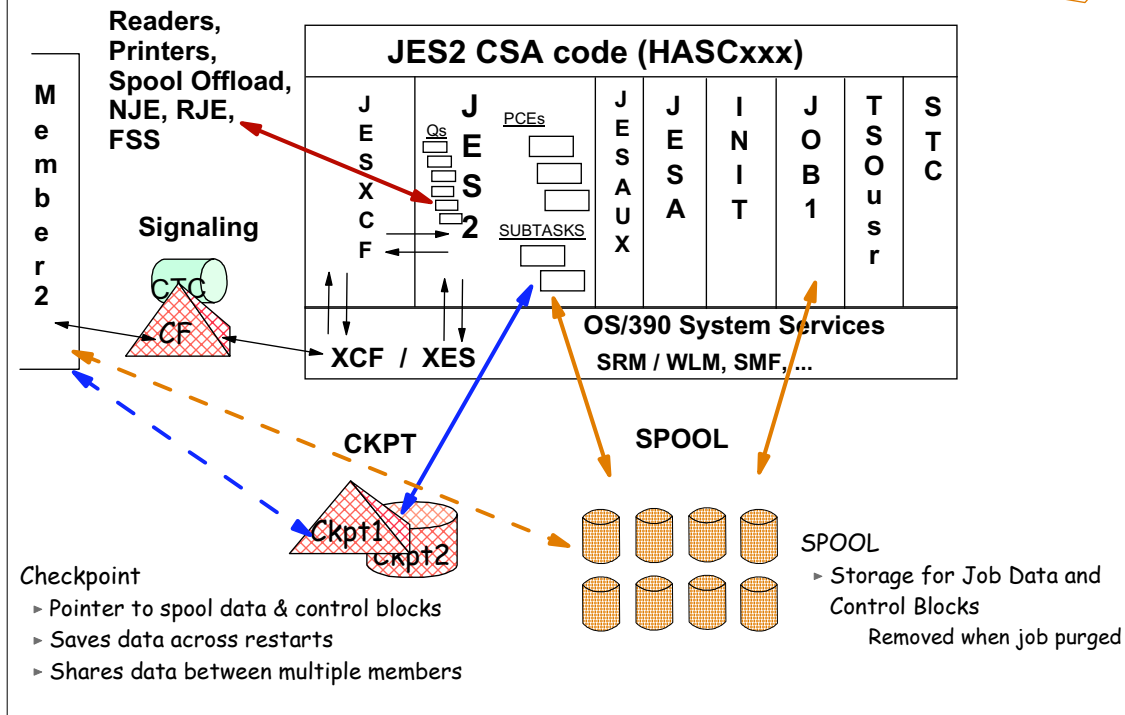


■ "MAS" Complex can have up to 32 Members:

- ▶ Must be in the same Sysplex (Timer, XCF, CDS)
 - Parallel sysplex NOT required (only for Ckpt on coupling facility)
- ▶ Must be "Compatible" (usually + or - 3 Releases)
- ▶ Are Peer-Coupled; no master-slave; Devices anywhere
- ▶ Share Queues by taking turns reading/writing Checkpoint



JES2 has many Parts ...



Customizing your JES2 Environment



1. JES2 Init Parm

- ▶ Take the defaults unless you know differently

2. JES2 Exits

- ▶ Requires skills w/ ALC & JES2 Internals
- ▶ MVS Exits (SMF, TSO, PSF) also available
- ▶ Use only when necessary

3. JES2 Table Pairs

- ▶ Used by many JES2 processes (WS, Init, PCE, ...)
- ▶ IBM, Installation, Vendor tables

4. JES2 Source Code ...

JES2 Initialization



- **Automatically Started if Primary Subsystem**
 - ▶ Make your JES2 procedure "bullet-proof"
 - ▶ Specify options: 'warm,noreq'
- **Initialization Parameters**
 - ▶ Define size, attributes & status of JES2 resources
 - ▶ Use the IBM defaults unless you know better
 - ▶ Customer specific processing options & Devices
- **Organize your init deck; share it between members**
 - ▶ Global parms: Spool, Checkpoint, JobClass, defs
 - ▶ Devices: Local, Remote
 - ▶ System-specific (use &symbolics in a MAS environment)
 - ▶ Use INCLUDE & PROCLIB statements new with z/OS R.4 & 5

Sample JES2 procedure



```
//JES2   PROC DSN1='SYS1.PROCLIB',          * PRIMARY PROCLIB      *
//          DSN2='SYS2.USRPROC',          * USER PROCLIB        *
//          STEPLIB='SYS1.JES2.SHASLINK', * JES2 PGM LIBRARY    *
//          TYPE=HAS,                      * DEFAULT NAME ALTERNATE *
//          PARMSUF=, LOCLSUF=, NJESUF=,   * PARM MEMBER SUFFIXES *
//          MBR=JES2PARM,                  * EMERGENCY PARMS     *
//          OPT='WARM,NOREQ'                * REPLY TO INIT OPTIONS *
//IEFPROC EXEC PGM=HASJES20,DPRTY=(15,15),TIME=1440,
//          PARM=(&OPT.)                    * INIT. OPTIONS        *
//STEPLIB DD DSN=&STEPLIB,DISP=SHR
//PROC00 DD DSN=&DSN1,DISP=SHR
//          DD DSN=&DSN2,DISP=SHR
//PROC01 DD DSN=&DSN2,DISP=SHR              * ALTERNATE PROCLIB *
//HASPPARM DD DSN=SYS1.PROCLIB(&TYPE.PARM&PARMSUF),DISP=SHR
//          DD DSN=SYS1.PROCLIB(&TYPE.LOCL&LOCLSUF),DISP=SHR
//          DD DSN=SYS1.PROCLIB(&TYPE.NJE&NJESUF),DISP=SHR
//          DD DSN=SYS1.PROCLIB(&SYSNAME.PRM),DISP=SHR
//OTHER   DD DSN=SYS1.PROCLIB(&MBR),DISP=SHR * ALTERNATE PARMS   *
//HASPLIST DD DDNAME=IEFRDR                * LISTING FILE       *
```

- **Testing the JES2 proc ...**
 - ▶ "start JES2" on top of an already running JES2 (it won't get far)
 - ▶ Use Poly-JES (more later)
 - ▶ See z/OS R.2 - Dynamic Proclibs & Include statements!

JES2 Start-up Options



- **Cold-Start {Format}**
 - ▶ Was done the very first time your installation started JES2
 - ▶ All spooled jobs and data are lost {SPOOL space formatted}
- **All-Member Warm Start**
 - ▶ IPL & Restart of JES2 with no other members active
 - ▶ Rebuild damaged control blocks (seldom required)
- **Single System Warm Start (or Quick Start)**
 - ▶ Single system Restart of JES2 after IPL or JES2 quiesced
- **Hot Start**
 - ▶ Restart JES2 after ABEND without an IPL
 - ▶ Jobs running before ABEND continue running (may wait on JES2 for TGs, etc.)

JES2 Init ParmS - samples



```

CKPTDEF      CKPT1=(STR=xxxx,INUSE=YES),
              CKPT2=(DSN=SYS1.JES2.CKPT1,VOL=CKPTV1),
              NEWCKPT1=(DSN=SYS1.JES2.CKPTBK1),
              NEWCKPT2=(DSN=SYS1.JES2.CKPTBK2), ...

SPOOLDEF     DSNAME=SYS1.HASPACE, VOLUME= SPOL,
              TGBPERVL=255, TGFSIZE=30, TRKCELL=12, FENCE= ...

MASDEF       HOLD=50,DORM=(50,500)

JOBCLASS(*)  JOURNAL=NO, SWA=ABOVE, ...

PCEDEF       xxxNUM=10

NODE29       NAME=WSCJES2

PRINTER(3)   xxxNUM=10

LINE(10-30)  UNIT=SNA
  
```

... Plus many more

JES2 Parameter Changes



- **Most Parms can be Changed or Added Dynamically**
 - ▶ \$T and \$ADD Commands
 - ▶ System Display & Search Facility (SDSF) program product
 - ▶ Keep your init deck up-to-date as you change them

- **Notable Exceptions (non-dynamic parms):**
 - ▶ Hot-Start: PCENUMs, some Device settings
 - ▶ Single-member Warm start (IPL): Exits
 - ▶ All-Member Warm start: CKPTDEF
 - ▶ Cold-start Parms: SPOOLDEF

Availability Issues



- **JES2 System Availability**
 - ▶ Thoroughly test all maintenance & exits in all your environments
 - ▶ Use JES2 automated restart functions - minimize JES2 down time

- **Reliable Spool (Job input & output, JCL, & Control Blocks)**
 - ▶ Use reliable DASD (or use hardware duplexing)
 - ▶ Minimum volume fencing can limit the damage (but hurt performance)
 - ▶ Spool Offload can be used to archive important jobs/SYSOUT
 - ▶ Use \$SSPOOL; \$PSPOOL to add and delete - Never use DFDSS, etc.!

- **Protect your Checkpoints (contain the pointers to all spool data)**
 - ▶ Always use CKPT1 & CKPT2, NEWCKPT1 & NEWCKPT2
 - ▶ Use Reconfiguration Dialog to recover or move - Never use DFDSS!

- **Other operations - wide range of JES2 Commands**
 - ▶ Watch out for Unauthorized & Dangerous Commands: \$PJQ

- **Secure all these with SAF/RACF**

JES2 Security



- **Protect System Data Sets (RACF DSNAMES profiles)**
 - ▶ Spool, Checkpoint, Spool Offload
 - ▶ Program Libraries, Parmlibs (init deck), Proclibs
- **Use SAF/RACF classes instead of JES2 parms**
 - ▶ Input Sources - JESINPUT, NODES
 - ▶ Job Submission & Cancel - JESJOBS
 - ▶ Output Printers & Transmission - WRITER
 - ▶ Commands - OPERCMDS
 - ▶ Spool Data - JESSPOOL
 - ▶ Exits (36, 37) can be used to override, but not recommended
- **See "JES2 Init & Tuning Guide" (chapter 7)**
 - ▶ Also "RACF Security Administrator's Guide"

JES2 Systems Management



- **Systems Management Facility (SMF) records**
 - ▶ Controlled by SMF and JES2 parameter settings
 - ▶ Job related:
 - Purge (26)
 - Output (6)
 - NJE SysoutTransmission (57)
 - ▶ RJE/NJE Line/Session:
 - Start Line, RMT Signon (BSC - 47, SNA - 52)
 - Stop Line, RMT Signoff (BSC - 48, SNA - 53)
 - Line or RMT Password Error (BSC - 49, SNA - 54)
 - ▶ JES2 Subsystem:
 - Start (43)
 - Stop (45)

New JES2 features



- **Initiators**
 - ▶ WLM initiator management - Rel.4 \$ACTIVATE
- **Routing jobs to specific resources**
 - ▶ Scheduling Environments (WLM) - Rel.4 \$ACTIVATE
- **NJE Networks**
 - ▶ Subnets, Dynamic Connects, \$DPATH, \$DCONN
- **RJE workstations**
 - ▶ Dynamic Changes, Enhanced Diagnostics
- **Spool Offload**
 - ▶ Archive abilities enhanced with Rel. 1
- **FTP site filetype=jes**
 - ▶ put, dir, get - enhanced with OS/390 R.10 Comm. Server
- **Dynamic Proclibs & Include statements**

JES2 Maintenance



- **JES2 is "Source-Maintained"**
 - ▶ Use SMP/E set-up jobs in SHASSAMP
- **Stay Current on JES2 Maintenance!**
 - ▶ Latest RSU level if possible
 - ▶ Avoids re-discovery of errors
 - If you have problems, IBM service may want you to get current and re-create problem
- **Read the PSP bucket**
 - ▶ Upgrade= OS390Rnn, Subset= JES2
 - ▶ Upgrade= ZOSV1Rnn, Subset= JES2
 - ▶ Review HIPERS

Testing - use "Poly-JES"



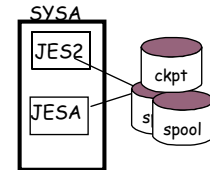
... also known as "Secondary JES", or "Alternate JES"

■ Configurations: Same MAS as Primary, or Separate

– Each subsystem in an MVS system requires a unique ComChar

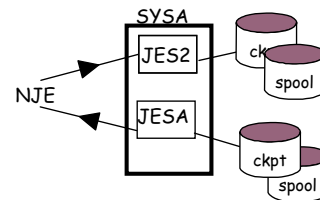
a. Member of Primary MAS:

- Share Spool, Checkpoint, Queues, ...
- Load modules usually the same



b. Separate MAS (Separate NJE Node):

- Own Spool, Ckpt, Queues, Load Modules,...
- Connect to Primary JES via NJE
- More isolated for "risky" testing



Debugging



■ Recognizing a Problem:

- ▶ Messages, Commands, SDSF, Syslog, User phone call

■ Diagnosis - Use these before you need them

- ▶ Commands/Messages (eg, \$HASPO88 ABEND Analysis)
- ▶ \$TRACE (IDs) & formatters
- ▶ DEBUG Facility
- ▶ Dumps - IPCS - JES2 Formatters
 - Multi-system dumps (OS/390 Rel. 10)
- ▶ LogRec - SymRecs - EREP
- ▶ CTRACE - under direction of IBM Level 2
- ▶ FSS, GTF, VTAM, NCP, etc. Traces

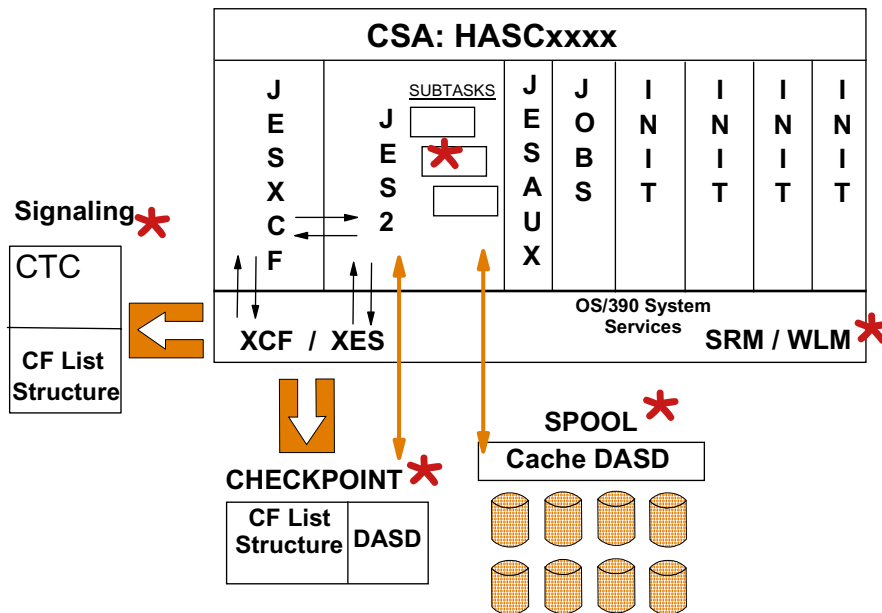
■ See "JES2 Diagnosis" & "JES2 Messages"

JES2 IPCS Support



- **You must be proactive: install JES2 IPCS function**
 - ▶ Make sure JES2 IPCS support works before you need it
 - ▶ Set up for all combinations of JES2 and MVS releases
- **Use the correct libraries for JES2 control blocks:**
 - ▶ SHASPARM in the PARMLIB concatenation
 - ▶ SHASMIG in the STEPLIB concatenation
 - ▶ SHASPNLO in the ISPPLIB concatenation
- **For more information, see:**
 - ▶ "JES2 Diagnosis"
 - ▶ "JES2 Migration Notebook"
 - ▶ "MVS IPCS Customization"
 - ▶ Enhancements in APAR OW33073 (0005) & OW46462 (0012)

Tuner's View of JES2



Performance



- **In general, JES2 takes minimal Resources**
 - ▶ Exceptions: Large Q's, Many Devices, Exits, OEM subsystems
- **Monitoring JES2 Performance**
 - ▶ SDSF, RMF, \$TRACE (1, 2, 17, 20, 30, 31)
 - ▶ Main Task CPU utilization detailed with \$D PERFDATA cmd
 - ▶ Watch "Sympathy Sickness" (delays caused by other members)
- **Tuning JES2**
 - ▶ Spool most important
 - ▶ Make sure you have enough resources (TGs, JQEs, JOEs, Bufs)
 - ▶ Checkpoint performance is usually not an issue
- **Don't worry - be happy**
 - ▶ Get Baseline #s - Know your "Happy Values"

JES2 Capacity Planning



- **As workload grows, so does ...**
 - ▶ **JES2 internal capacity requirements**
 - # of Jobs
 - # of Output Elements
 - Spool Space
 - Checkpoint Size
 - ▶ **JES2 CPU, I/O, & Storage Activity**
 - Devices, Initiators
 - Buffers
 - Queue length
 - ▶ **# of Members in the MAS Complex**
 - Spool Contention
 - Checkpoint Contention
 - Systems Management Complexity

Summary



1. **Understand the peculiarities of JES2**
 - ▶ Read and Experiment
 - ▶ Test with Poly-JES
2. **Keep it simple ...**
 - ▶ Minimize Mods & Exits
 - ▶ Discourage non-standard uses
3. **Automate the management of JES**
 - ▶ Set it up once; keep it up forever

Appendix



- **History of JES2**
- **Current Releases**
- **Reference Material**
 - ▶ Books, ...

36 Flavors of JES2 !



HASP

HASP I V.1 OS/MFT-I
 HASP I V.2 RJE (STR)
 HASP II V.1 MVT-II, MVT
 HASP II V.2 BSC RJE
 HASP II V.3 S/370
 HASP II V.4 SVS + PRPQs

MVS

JES2 R.2 MVS
 JES2 R.3 Shared Spool
 JES2 R.4 3800, SNA RJE
 JES2 R.4.1 3790 MLU RJE

NJE

NJE R.1 NJE
 NJE R.2 3790 RJE
 NJE R.3 SNA NJE

MVS/SP

SP 130/210 Exits, Spool Offload
 SP 133/211 Dynamic Spool
 SP 134/212 AFP
 SP 136/215 Spool Constraint Relief
 SP 2.2.0 Checkpt Enhancements
 SP 3.1.1 Constraint Relief, CSO
 SP 3.1.3 RACF Security
 SP 4.1.0 Output, NJE
 SP 4.2.0 APPC, Dynamic I/O
 SP 4.3.0 CUPRIMD Quality
 SP 5.1.0 Parallel (32-Way MAS)
 SP 5.2.0 Sysplex, ARM, JobQ

OS/390

OS/390 1.1 OS/390 Packaging
 OS/390 1.3 SAPI
 OS/390 2.4 WLM Batch
 OS/390 2.5 Open Print
 OS/390 2.7 FiCon Channel support
 OS/390 2.8 CF Auto-Rebuild Ckpt
 OS/390 2.10 Spool Fencing, Zap Job

z/OS

z/OS V1.R1 = OS/390 R. 10
 z/OS V1.R2 >64Kjobs, Dyn.Proc
 z/OS V1.R4 Health Monitor
 z/OS V1.R5 Multi-level Security

Current JES2 Releases



■ FMIDs, Birthdays & Obituaries

JES2 Rel.#	FMID	First Available	No Longer Available	End of Service
OS/390 R.8/9	HJE6608	9/99	9/00	9/2002
OS/390 R.10	HJE7703	9/00	3/02	3/2004
z/OS R.1	HJE7703	3/01	10/01	3/2004
z/OS R.2	HJE7705	10/01	9/02	3/2005
z/OS R.4	HJE7707	9/02	3/04	3/2007
z/OS R.5	HJE7708	3/04		

See <http://www.ibm.com/services/sl/products/java.html>
 (requires JVM 1.3)

JES2/MVS Compatibility



OS/390 Release	JES2 Release:			
	R.10 & z/OS R.1 HJE7703	z/OS R.2 HJE7705	z/OS R.4 HJE7707	z/OS R.5 HJE7708
R.10	X			
z/OS R1	X			
z/OS R2	X	X		
z/OS R3	X	X		
z/OS R4	X	X	X	
z/OS R5	X	X	X	X

From Rel. 10 on, JES levels supported by a given OS/390 release will be the same as the JES levels that can coexist in a MAS.

References



- **Education:**
 - ▶ JES2 for OS/390 Facilities & Implementation (ES710)
- **JES2 Library:** Hard-copy, CDROM, WWW
- **JES2 Source Code:** xx.SHASSRC & xx.SHASMACH
- **JES2 Samples:** xx.SHASSAMP
- **TechDocs:** www.ibm.com/support/techdocs
- **IBMLink (Q & A), Forums, Listserv-JES2, ..**
- **SHARE Presentations**
- **Other JES2 SysProgs:** SHARE & local user groups, your predecessor!

z/OS JES2 LIBRARY



SA22-7535	JES2 Introduction *
GA22-7538	JES2 Migration
SA22-7532	JES2 Initialization & Tuning Guide
SA22-7533	JES2 Initialization & Tuning Reference
SA22-7537	JES2 Messages
SA22-7526	JES2 Commands
SA22-7527	JES2 Commands Summary
SA22-7534	JES2 Installation Exits
SA22-7536	JES2 Macros
GA22-7531	JES2 Diagnosis
GA22-7528	JES2 Data Areas, V.1 \$A - \$E *
GA22-7529	JES2 Data Areas, V.2 \$F - \$O *
GA22-7530	JES2 Data Areas, V.3 \$P - \$X *

★ SoftCopy only (CD-ROM)

Other JES2-Related Documents



- ▶ z/OS V1 R2 Implementation, SG24-6235
- ▶ OS/390 V2 R10 Implementation, SG24-5976
- ▶ OS/390 V2 R4 Implementation, SG24-2089
- ▶ MVS/ESA JES2 V.5 Implementation, GG24-4583
- ▶ VSE to OS/390 Migration Notebook, SG24-2043
- ▶ NJE Formats & Protocols, SC23-0070-3
- **Deleted (obsolete) - save your old copies**
 - ▶ ~~MVS/ESA JES2 Exit Coding, GG24-4127~~
 - ▶ ~~SDSF/RACF 1.9.2 Conversion, GG24-4085~~
 - ▶ ~~NJE with JES2 and Other Systems, GG22-9339-1~~
 - ▶ ~~OS/390 R.5 Implementation, SG24-5151~~
 - ▶ ~~JES2 MAS in Sysplex Environment, GG66-3263~~

z/OS Softcopy Books



■ z/OS Softcopy Collection CD-ROMs

- z/OS CD-ROMs: SK3T-4269 (Unlicensed)
 - ◆ available on tape (optional, no-charge feature)
- Software Products: SK3T-4270
- z/OS & S/W Products - DVD: SK3T-4271
- Licensed z/OS CD-ROM: LK3T-4307

■ Softcopy site:

<http://www.ibm.com/servers/eserver/zseries/softcopy>

■ Online books at:

<http://www.ibm.com/servers/eserver/zseries/zos/bkserv>

■ JES2 PDF files:

<http://www.ibm.com/servers/eserver/zseries/zos/bkserv/r2pdf/jes2.html>

■ See what's new:

<http://www.ibm.com/servers/eserver/zseries/softcopy/whatsnew.htm>

z/OS Web Sites



■ z/OS Home Page (announcement letters, support, coexistence)

▶ <http://www.ibm.com/servers/eserver/zseries/zos>

■ Planning for Installation

▶ <http://www.ibm.com/servers/eserver/zseries/zos/installation>

■ SDSF (Pubs, Presentation, Customization Wizard)

▶ <http://www.ibm.com/servers/eserver/zseries/zos/sdsf/sdsfhp.html>

■ Education

▶ <http://www.ibm.com/services/learning/us/>

■ Advanced Tech. Support (WSC Flashes, etc.)

▶ <http://www.ibm.com/support/techdocs>

■ Redbooks:

▶ <http://www.redbooks.ibm.com>

Questions

