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)

- *(the real reason: History …)*
  - Efficiently manage system resources

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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 across the MAS (CNVTs, XEQs, HOPEs, XMITs, PURGs)
  - Uses $QGET, Work-Select Tables, Exit 49/14, ...

JES2 Output Queuing Mechanisms

- **Output Queuing & Selection**
  - 110 Output (HardCopy) Queues
    - (Hold, NJE, 36 local (A-Z, 0-9), 36 Rmt, 36 User)
    - Ordered FIFO within Prty within User/DestID (may be Priority Aged)
  - Output Elements (JOEs) selected across MAS
    - First-come-First-served by Output Queue PCEs (PRTs, PUNs, XMITs, FSSs)
  - Uses $#GET, PSO, SAPI
  - WS (Work Select) Specifications & Tables
    - (no Exit)
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 - 2 Releases)
  - Are Peer-Coupled; no master-slave; Devices anywhere
  - Share Queues by taking turns reading/writing Checkpoint

Customizing your JES2 Environment

1. JES2 Init Parms
   - 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
   - 6 Sessions on "JES2 Exits": 2656, 2662-2666 in SHARE proceedings for Baltimore, 8/2006

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 &symbols in a MAS environment)
  - Use INCLUDE & PROCLIB statements

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Sample JES2 procedure

```plaintext
//JES2    PROC N='SYS1',L=SHASLINK, The STEPLIB is N,L
//             PN=SYS1,PL=PARMLIB, InitParms in
//             M=JES2PARM PN.PL(M)
//IEFPROC EXEC PGM=HASJES20,TIME=1440,DPRTY=(15,15),PARM=(NOREQ)
//HASPLIST DD DDNAME=IEFRDER
//HASPPARM DD DSN=&PN..&PL(&M),DISP=SHR
//*         DD DSN=&PN..&PL(&M2),DISP=SHR Concatenate other
/* members here by adding additional M2
/* symbolic parm to PROC statement above
//STEPLIB DD DSN=&N..&L,DISP=SHR
```

- **Testing the JES2 proc ...**
  - "start JES2" on top of an already running JES2 (it won't get far)
  - Use Poly-JES (more later)

- **Note: Proclibs removed from the JES2 Proc.**
  - Replaced by PROCLIB initialization statements
PROCLIB & Include statements

- Simplify JES2 PROC
  - EXEC, STEPLIB DD, one HASPPARM DD
  - Define PROCLIBS via PROCLIB statement
  - INCLUDE additional DD statements
- In emergency, start JES2 without a PROC!
  - $IEESYSAS, PROG=HASJES20, JOBNAME=JES2
  - Assumes HASJES20 in LINKLIST (no STEPLIB)
  - When HASPPARM allocation fails, reply to $HASP469 message
    - INCLUDE statement(s) for correct init deck(s)
    - PROCLIB statements (if not in init decks)
- Operator commands:
  - $ADD, $T, $DEL, $D PROCLIB(nnnnnn)

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 Track Groups, etc.)
Use the default values, unless you know better!

Organize them by:
- Global xxxDEF Parms
- Job & Output classes
- Local Devices
- RJE/NJE
- System-Specific
- Operator commands

Include from another member (system-specific)

Display parms to the operator:
- Ask Operator to enter any parms.

Issue JES2 and MVS commands...
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
    - Exits & Load Modules dynamic with APAR OA21346
  - All-Member Warm start: CKPTDEF
  - Cold-start Parms: SPOOLDEF

JES2 Operator Commands

- JES2 Commands in general:
  - Start with $, Folded to upper case, Blanks removed
  - Multiple commands on 1 line w/ semicolons: $da;du;dn,all
  - /* Comments delimited as in REXX */
  - Powerful syntax can also be a challenge!

- Filters
  - Subscript ranges: $P INIT(9 - 11)
  - Keyword limiting: $T O JOBQ,/FORMS=123,FCB=456
  - Wildcards: * for multiple characters, % for 1 character
  - Jobmask for Jobnames: $C JOBQ,JM=A%C*, . . .
  - Display limiting: $D MODULE(*),LOADMOD

Session 2669 "Exploiting JES2 Commands" Th. @ 3
JES2 Automation

- JES2 already automates several functions
  - Set init parms to enable these Recovery Actions:
    - MASDEF AUTOEMEM=ON, RESTART=YES
    - CKPTDEF NEWCKPTn=xxxx, OPVERIFY=NO
    - NJEDEF, LINE, NETSERV RESTART=(YES,10) - New with JES2 z10

- Common house-keeping chores . . .
  - Clean up old spool files:
    - $P O JOBQ, /Q=S, /Days >4 /*Class S output older than 4 days*/
    - $P JQ, /DAYS > 7 /*Purge all Jobs older than 7 days*/
    - $T A, I=86400, '$PJQ, /DAYS > 7' /*Use Automatic Commands*/
  - Keep Lines started & Nodes connected:
    - $T A SLNE, I=3599, '$S LINE(2-27)' /*Start all SNA Lines*/
    - $T A SNL2, I=3600, '$SN,LINE2,N=WSCNEXT'

External Automation

- System/Message-based Automation
  - Resource Shortages - $HASP050 message
    - Spool (Track-Groups), JQEs, JOEs at 80%
    - Free up resources (Re-route or Delete old jobs)
    - Add spool volume or use Spool Offload
    - Notify Systems Programmers
  - RJE/NJE Line Monitoring
    - $HASP203, $HASP210, (OW43270) Line Dropped
    - Restart the line, session
    - Periodically issue $S LINE(*) command
  - JES2 1.10: Network Monitor
    - Automatically re-start NJE connections (every 10 min.)
You can do it all with SDSF!
"System Display and Search Facility"

- **Browse Syslog & Issue Commands**
  - Programmers also use it to browse job output

- **Manage Devices**
  - Printers, Lines, Nodes, Spool Offload, Spool, Initiators

- **Manage Job & Output Queues**
  - Input, Active, Held, Output, Local & Remote

- **Monitor & Manage JES2 & System Resources**
  - RMF data for active address spaces
  - MAS use of Checkpoint
  - Scheduling Environments
  - Job Class Definitions

JES2 Operations - SDSF Panels

- **Manage System Resources**
  - MAS JES2 members in the MAS
  - INIT JES2 initiators
  - LOG System log
  - ULOG User session log
  - SR System requests
  - JC Job classes (MAS)
  - SE Scheduling environments
  - RES WLM resources (MAS)
  - ENC Enclaves
  - PS z/OS UNIX processes
  - CK IBM Health Checker for z/OS
  - RM JES2 resources

- **Devices (MAS-wide with MQ)**
  - INIT Initiators
  - PR Printers
  - PUN Punches
  - RDR Readers
  - SO Offloaders
  - LINE JES2 lines for NJE, RJE
  - NODE NJE nodes
  - SP Spool volumes

- **Jobs and Output (MAS-wide)**
  - DA Active users
  - I Input queue
  - O Output queue
  - H Held output queue
  - ST Status of all jobs
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 $S SPOOL; $P SPOOL 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: $P JQ

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

JES2 Security

- **Protect System Data Sets (RACF DSNAME 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
    - SMF: SYS1.PARMLIB(SMFPRMxx)
    - JES2: JOBCLASS(x) TYPE6=Y, TYPE26=Yes
  - Job related:
    - Purge (26)
    - Output (6)
    - NJE SysoutTransmission (57)
  - Other:
    - SMF 30 (Common Address Space Work - not written by JES)
    - Misc. JES2 SMF records:
      - Start NJE/RJE Line, RMT Signon (BSC - 47, SNA - 52)
      - Stop NJE/RJE Line, RMT Signoff (BSC - 48, SNA - 53)
      - Line or RMT Password Error (BSC - 49, SNA - 54)
      - JES2 Subsystem Start (43), Stop (45)

JES2 Maintenance

- 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
- JES2 is "Source-Maintained"
  - Use SMP/E set-up jobs in SHASSAMP to Assemble/Linkedit
    - (Don't need if you don't have mods)
- Read the PSP bucket
  - Upgrade= ZOSV1R9, Subset= JES2
    - Review HIPERs
Testing with "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
  - **Member of Primary MAS:**
    - Share Spool, Checkpoint, Queues, ...
    - Load modules usually the same
  - **Separate MAS (Separate NJE Node):**
    - Own Spool, Ckpt, Queues, Load Modules,...
    - Connect to Primary JES via NJE
    - More isolated for "risky" testing

- **Good environment for SysProg Testing!**

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Debugging

- **Recognizing a Problem:**
  - Messages, Commands, SDSF, Syslog, User phone call

- **Diagnosis - Use these before you need them**
  - Commands/Messages (eg, $HASP088 ABEND Analysis)
  - $TRACE (IDs) & formatters
  - DEBUG Facility
  - Dumps - IPCS - JES2 Formatters
  - LogRec - SymRecs - EREP
  - CTRACE - under direction of IBM Level 2
  - FSS, GTF, VTAM, NCP, etc. Traces

- **See "JES2 Diagnosis" & "JES2 Messages"**
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 JES2
   - Set it up once; keep it up forever

See "JES2 Latest Status" presentation for more!

SHARE JES2 web site

http://www.share.org/Volunteer_Center/programs/jes2_project.cfm

- Project News
- Project Officers
- Agenda for current SHARE
- Proceedings of past SHARE sessions

This project facilitates communication among IBM and customers who run JES2 or any certain related vendor's products, that the project has taken under its wing.

1. IBM teaches customers how to derive increased value from the product through fuller and wiser utilization of feature and function.
2. Customers share with each other their experiences with the product in order to maximize the return they derive from their investment in it.
3. Customers submit requirements to IBM for enhancements and modifications to the product. These requirements guide IBM's allocation development efforts so that the greatest good may be realized from the resources expended.

JES2 Project News
The JES2 Project always plans a full week of valuable technical sessions on JES2. See agenda for the upcoming Technical Conference on the SHARE Home Page.

JES2 Project Web Links
The following links on the Web site are provided to enhance your visit to this site. If you would like to suggest additional links, use the mailto address of the Project Manager.

- IBM JES 2 Home Page
- JES2 2.7 Marathon page and related JES2 2.7 Marathon Flash
- JES2 Sessions from August 2007 (Tampa)
References

- **Education:**
  - JES2 for OS/390 Facilities & Implementation (ES710)
- **JES2 Library:** Hard-copy, CDROM, InfoCenter
- **JES2 Source Code:** xx.SHASSRC & xx.SHASMAC
- **JES2 Sample Exits:** 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
- SA23-2240 z/OS JES Application Programming
- SA22-7539 Network Job Entry Formats and Protocols

- **JES2 z/OS R9 PDF files:**