Exploiting JES2 Commands
- Introduction to JES2
  for System Operators

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What do you need to know to be a good JES2 Systems Operator?

- How JES2 works & why it needs an operator.
  - Job & Output Spooling, Queuing, Selection & Disposal
  - Device Monitoring & Management
  - Security & Authorization

- See what's going on, what's not, & how to fix it.

- Mastering the $command language

- Advanced Topics
  - Spool & Checkpoint Reconfiguration, Spool Offload,
    Automation, Security, Poly-JES, Performance, Debugging

- References .... (where to turn for help)
Why do you need JES, anyway?

- **Enter Jobs, TSO Users, STCs**
  - Internal Readers, Remote readers, NJE nodes, Spool Offload

- **Schedule Batch Job Execution**
  - Queue jobs before and after execution
  - Storage for spool files (SYSIN, SYSOUT)

- **Distribute Output**
  - Printers, Remotes, NJE nodes, offload, and other.

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**JES2 Configurations**

- **Single system**
  - Local Readers & Writers
  - Remote Readers & Writers (RJE)
  - Connect to remote systems (NJE)

- **MultiAccess Spool (MAS) node w/ 1 - 32 Members:**

- **Multiple nodes (JES, VM, etc.) connected via NJE**
Why do you need an Operator, anyway?

- **Control JES2**
  - Start, Stop JES2
  - Restart, Diagnose, Fix, & Recover

- **Control Devices**
  - Start, Stop, Change Attributes & Behavior

- **Manage Jobs & Output**
  - Input and Print Queues
  - Manipulate Individual Jobs

- **Monitor**
  - Performance
  - Health

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JES2 Start-up

- **Automatically Started at IPL if Primary Subsystem**
  - Make your JES2 procedure "bullet-proof"
  - Specify 'noreq' option so operator is not prompted.

- **Manual Start-up (after a failure)**
  
  ```
  s jes2,parm='warm,noreq,...'
  ```
  - other Options to List or Change Parms, Validate Spool, Reconfigure, CKPT2, etc.

- **Initialization Parameters**
  - Define size, attributes & status of JES2 resources
  - Customer specific processing options & Devices
JES2 Init Deck (JES2 Parms)

- **Member(s) in SYS1.PARMLIB (or PROCLIB)**
  - Pointed to by JES2 procedure
  - Basic Configuration: Spool, Checkpoint, Queue Sizes, Buffers
  - Operational characteristics based on historical preferences
  - Device definitions and settings
  - lots of anachronistic miscellaneous things

```plaintext
CONDEF CONCHAR=$, DISPLEN=64, DISPMax=100, BUFNUM=100, ...
CKPTDEF CKPT1=(STR=xxxx,INUSE=YES),
          CKPT2=(DSN=SYS1.JES2.CKPT1,VOL=CKPTV1),
          NEWCKPT1=(DSN=SYS1.JES2.CKPTBK1),
SPOOLDEF DSNAME=SYS1.HASPACE, VOLUME= SPOL, SPOOLNUM=32,
PRINTER(1) CLASS=A, FORM=STD7, ...
```

Sample JES2 procedure

- **Starting JES2**
  - `s jes2,parm='warm,noreq'
  - `s jes2,haspparm=testprms`

```plaintext
//JES2    PROC STEPLIB='SYS1.JES2.SHASLINK', * JES2 PGM LIBRARY      *
//             TYPE=HAS,                    * DEFAULT NAME ALTERNATE *
//             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
//HASPPARM  DD DSN=SYS1.PARMLIB(&TYPE.PARM),DISP=SHR
//          DD DSN=SYS1.PARMLIB(&TYPE.LOCL),DISP=SHR
//          DD DSN=SYS1.PARMLIB(&TYPE.NJE),DISP=SHR
//HASPLIST  DD DDNAME=IEFRDER                    * LISTING FILE      *
```
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 continue running . . .

JES2 Parameter Changes

- **MostParms can be Changed or Added Dynamically**
  - $T \ (change) \ $ADD \ and \ $DEL \ Commands
  - System Display & Search Facility (SDSF)
  - 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 (until OA21346)
  - Cold-startParms: SPOOLDEF BUFSIZE, DNAME, TRKCELL, VOL
Stopping JES2

- Reasons for Stopping JES2
  - Scheduled outage (hardware or software maintenance)
  - Change parameters (e.g., JES2 exits)
  - Unscheduled outage

- Types of JES2 termination
  - $PJES2 requires a totally dormant system (see $HASP607)
  - If you plan to IPL, use: $PJES2,TERM
  - If you don’t want to IPL (hot start JES2): $PJES2,ABEND
  - JES2 Catastrophic error

- Quiescing JES2
  - $P
  - $D JES2 to see what’s still running...

Availability Issues

- JES2 System Availability
  - Use automated restart functions - minimize JES2 down time

- Spool - Job input & output, JCL, & Control Blocks
  - Use $S SPOOL; $P SPOOL to add and delete
    - *Never use DFDSS, etc.!!*
  - Spool Offload to archive important jobs/SYSOUT

- 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
Running Jobs

More than just decks from card readers:

- Jobs run under an Initiator, managed by Job Class:
  - Batch jobs from Internal Readers (intrdr), Local & remote readers, from other NJE nodes

- Initiators managed according to Job Class:
  - JOBCLASS(x) MODE=JES | WLM

- No Initiator needed:
  - TSO Logons
  - Started Tasks, Started Jobs (operator initiated) $S J
  - APPC Users
  - OS/390 Unix Shells

JES2 Job Queues

Order & 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 Class

Display and Manipulating

- By Queue, By Job, By Groups of Jobs (Filters)

JES2 Initiators

- Managed by JES2 Parameters & Operators
- Managed by Vendor Scheduling Products

WLM Initiators

- Managed by Workload Manager
Phases of Job Processing

- Every Job (& STC & TSU) has gotta be somewhere!

Why isn't this Job running?

- **Job attributes:**
  - Held? Duplicate job name?
  - Job Class (JES mode) match available Initiator
  - System Affinity, or Scheduling Environment, or IND mode

- **WLM Mode Initiator**
  - WLM in Goal Mode, Resources Available, Service Obj. & PI
  - QHELD=YES? XEQCOUNT=MAX=limit exceeded?

- **System resources available:**
  - System Draining, or $PXEQ
  - SPOOL volumes not available
  - System in INDependent mode
Why won't this job run?

- **Display commands:**
  
  - `$D job,DELAY` or `$D JOBQ,DELAY= ...`
  - Hold, Sysaff, Schenv, Limit, Locked, Busy, Spools, Member
  
  - `$D job,LONG`
  
  - `$D JOBCLASS(x)`
  
  - `$D MEMBER`
  
  - `$D I < watch for INELIGIBLE_CLASS=(x-rsn,...)>`
  
  - `$D SPOOL`
  
  - `$S < watch for system draining>`
  
  - `$D WLM [,SYSTEMS] [,SCHENV=x] [,RESOURCE=x]`
  
  - `$D PERFDATA(SAMPDATA)`

Managing Individual Jobs

- **$C (cancel) job** sends it to the output queue
- **$P (purge) job** sends it to purge (no output)
- **$H (hold) job** holds it until released
- **$A (release) job** that was held
- **$E (restart) job** in execution will run it again

  - requeues it for re-selection by an initiator
  - `$E Job,Cancel` same as `$H j, $E j, $C j`

- **$D j, $T j, $R j, ...**
Output Distribution & Disposal

- Output created by Jobs, TSUs, STCs, APPC...
  - Managed by Job Output Elements (JOEs)
  - Queued by class
    - Local
    - Remote
    - User
    - Held
    - NJE node
  - Selected by printer, punch, transmitter, or Other Programmed APIs (PSO, SAPI, FSS)
  - Disposed by OUTDISP, $PURGE, "Garbage Collection"

JES2 Output Queues

- Order & Selection
  - 110 Queues (Hold, NJE, 36 local, 36 Rmt, 36 User)
    - Ordered FIFO within Prty within User/DestID
  - Output Elements (JOEs) selected FIFO by Queue

- Display and Manipulating
  - By Queue, By Job, By Groups of Job Elements (Filters)

- JES2 Printers & Punches (& Transmitters)
  - Work Selection Criteria WS=(a,b,c/x,y,z)

- FSS, PSO, & SAPI
  - PSF for page-mode printing
  - InfoPrint to TCP/IP connected printers
  - Print Output & Distribution systems (OnDemand) & Archivers
Why won't this Job Print?

- **Job Output Element (JOE) attributes:**
  - Job Held? OUTDISP=WRITE?
  - Output Class match available Printer
  - Form, WriterID, Route code, etc.
    - attributes match Printer?

- **Security Authorizations:**
  - WRITER class permissions
  - SECLABEL settings

- **Printer attributes:**
  - Available & Idle
  - Matching characteristics
  - Work Selection criteria WS=(a,b,c/x,y,z)

It still won't Print!

- **System resources available:**
  - System Draining, or $PXEQ
  - SPOOL volumes not available
  - JOE Shortage?
  - Output Queues "Clogged Up"?

- **Helpful Commands:**
  - $D job, LONG
  - $D OJob
  - $T OJob
  - $D PRTn
  - $T PRTn
  - $D SPOOL
  - $S
Managing Devices

- **Readers, Printers & Punches**
  - Local, Remote, & FSS

- **Communication Lines**
  - RJE & NJE; BSC & SNA

- **NJE Nodes**
  - Logon(n), Lines, Xmiters, Receivers, Connections, Paths

- **Spool Offload Devices**
  - Similar to NJE Xmiters & Receivers

- **Spools & Checkpoints**

- **Initiators**
  - JES2 & WLM-managed

Helpful Commands

- $D
- $S, $P, $E, $Z
- $T (seT)
- $C (Cancel Job on ...)
- $B, $F (Back/Fwd Sp.)

$C, $E, $I, $P, or $Z ???

- **$C device**
  - Cancels (and purges) the job on that device.

- **$E device**
  - rEstarts the job on that device.
  - $Ejxx, Cancel == $Hj; $Cj; $Ej

- **$I device**
  - Interrupts activity with this job; go to next job.

- **$P device**
  - Drains device when finished with this job.

- **$Z device**
  - Temporarily Halts device without requeuing job
NJE Operations Examples

- **Starting NJE sessions:**
  - `$s logon1 <JES2 applID to VTAM if SNA>
  - `$s line10
  - `$s n,node=pokjes2

- **Stopping NJE sessions:**
  - `$p line10; eline10
  - `$p logon1

- **Display Nodes & Paths, etc,**
  - `$d node(pokjes2)
  - `$d path(pokjes2)

- **Control Nodes, Lines, Connections, etc.**

Dynamic TCPIP/NJE (Example)

- **On WSCPlex (WSC175):**
  ```
  /* ------------------------------ */
  /* JES2 NJE/TCP DEF's FOR WSC175 */
  /* CONNECTING TO NODE WSC180 */
  /* ------------------------------ */
  LINE(1-5) UNIT=TCP
  SOCKET(W175J2) NODE=175
  SOCKET(W180J2) NODE=180,
  IPADDR=9.82.24.150
  NETSRV1 SOCKET=W175J2
  ```

- **On WSCZPlex (WSC180):**
  ```
  /* ------------------------------ */
  /* JES2 NJE/TCP DEF's FOR WSC180 */
  /* CONNECTING TO NODE WSC175 */
  /* ------------------------------ */
  LINE(1-5) UNIT=TCP
  SOCKET(W180J2) NODE=180
  SOCKET(W175J2) NODE=175,
  IPADDR=9.82.24.69
  NETSRV1 SOCKET=W180J2
  ```

- **Using Operator Commands (same on both sides):**
  - Convert one or more LINEs from SNA to TCP ($T LINE1,UNIT=TCP)
  - Add Socket for local system ($ADD SOCKET)
  - Add Socket for remote system ($ADD SOCKET) with IPADDR=
  - Create NETSRV A/S ($ADD NETSRV)
  - $S NETSRV1 -- this creates a new A/S named JES2Snnn
  - Add RACF STARTED profile - assign a user with an OMVS segment:
    - `RADD JES2S.* CLASS(STARTED) STDATA(USER(OMVSUSER))`
  - `$S N,S=WSCxxxJ2`
JES2 Command Syntax

- **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 OJOBQ,/FORMS=123,FCB=456
  - Wildcards: * for multiple characters, ? for 1 character
  - Jobmask for Jobnames: $C JOBQ,JM=A?C, ...
  - Display limiting: $D MODULE(*),LOADMOD

JES2 Command Filters

- **Selection Limiting Keywords limit number of elements:**
  - $D PRT(*),CLASS=a*c
  - $D PRT(1-4,7)
  - $D NODE(WSC*),NAME

- **Display limiting keywords reduce the info per element:**
  - $D PRT,CLASS returns just the class of all printers

- **Use the slash '/' to filter elements on $T commands**
  - $T PRT(*),/Q=ab*,Q=abc
  - $T OJQ,/Q=x,/DEST=LOCAL,/OUTD=W,Q=y

- **See "JES2 Commands" Chapter 5 introduction**
Routing JES2 Commands & Messages

- Route command to another system:
  - MVS ROute command: RO sysb,$DA
  - $M2,'$DA'

- Routing to another NJE Node
  - $N175,'$D A'
  - $N,D=pokjes2,'$D LINE(10)'

- Routing Messages & Command Responses
  - $D PERFDATA,L=Z sends it to the out-of-line display area
    - Bypasses CONDEF DISPMAx limiting

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
SDSF to Operate/Manage JES2

- End-users, Programmers
  - Job & Output Displays

- Specialized Operators, Production Control
  - Devices (readers, printers, lines, nodes, spool offload)
  - JES2 Initiators (not WLM inits)
  - Job & Output Queues

- Lead Operators - above plus …
  - SYSLOG - Commands & Messages

- Systems Programmers - above plus …
  - MAS - Members of the Complex
  - Scheduling Environments & RESources
  - Job Classes

Advanced Operations Topics

- Spool Reconfiguration
- Spool Offload
- Checkpoint Reconfiguration
- Poly-JES
- Security
- Performance, Health Monitor
- Automation
- Debugging, Tracing
Spool Volumes

- Always use JES2 commands to manage spool volumes
  - Don't manage with DFDSS or other utilities
- Understand the different status characteristics:

<table>
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<th>Status</th>
<th>In Use</th>
<th>Allocatable</th>
<th>Selectable</th>
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<tr>
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<tr>
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</tr>
</tbody>
</table>

- Display Spool Volumes Status: $d spl,all
- Display Jobs on Spool Volumes: $d ojq,spl=spoolv,tgm

Spool Offload Operations

- Job & SYSOUT Transmitters
  - $T OFFLOADn, DSN=xxx, VOL=vvv
  - $T OFFn.JT, Class=x, WS=(CL)
  - $T OFFn.ST, Routecode=rrr, WS=(R)
  - $S OFFLOADn, TYPE=TRANSMIT
  - $P OFFLOADn
- Job & SYSOUT Receivers
  - $T OFFLOADn, DSN=xxx, VOL=vvv
  - $T OFFn.JR, Class=x, WS=(CL)
  - $T OFFn.SR, Routecode=rrr, WS=(R)
  - $S OFFLOADn, TYPE=RECEIVE
  - $P OFFLOADn

(Similar to NJE)
Checkpoint Reconfiguration Dialog

- Only supported way to move a checkpoint data set.
- Can also suspend & resume use of a checkpoint.
  - Ensures no loss of data if there is a checkpoint error
  - Data is written from memory thus ensuring currency
- Operator initiated: `$T CKPTDEF,RECONFIG=YES`
  - Used to move (enlarge), suspend, or resume a CKPT
  - Follow WTOR Messages carefully.
- Automatic: Error reconfiguration
  - The result of I/O error reading CKPT
- Keep track of where your checkpoint is, and where Operations can place a new one.
- See JES2 Init & Tuning Guide for a good overview.

Operation 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 Operator Training!
Performance Topics

- JES2 Health Monitor
- Warning Thresholds
- $D PERFDATA
- $TRACE points
- RMF, SMF

JES2 Health Monitor

Starts automatically, Supports the Following Commands:

$J D STATUS
  Displays current status of JES2 & Use to identify potential problems.

$J D JES
  Displays info about JES2 & Events that are being tracked but are not necessarily problems

$J D MONITOR
  Displays monitor task and module status information

$J D DETAILS
  Displays detailed information about JES2 resources, sampling and MVS waits. (Intended as a diagnostic aid.)

$J D HISTORY
  Display history information (up to 72 hours - very verbose!)
$D$ PERFDATA service aid commands

(undocumented - intended for service personnel - subject to change ??)

http://www.ibm.com/support/techdocs/atsmastr.nsf/PubAllNum/FLASH10008

- $D$ PERFDATA(INITSTAT) - JES2 initialization routines
- $D$ PERFDATA(QSUSE) - Checkpoint delays
- $D$ PERFDATA(PCESTAT) - PCE detailed statistics
- $D$ PERFDATA(CPUSTAT) - Summary of PCE stats
- $D$ PERFDATA(SAMPDATA) - WLM init sampling data
- $D$ PERFDATA(EVENT) - JES2 internal errors & delays
- $D$ PERFDATA(CKPTSTAT) - JES2 Checkpoint Performance
- $D$ PERFDATA(SUBTSTAT) - JES2 Subtask Performance

$D$ PERFDATA service aid commands

1248 1 2

# of cpus

0 10 20 30 40 50 60 70 80 90

$D$ PERFDATA service aid commands

TRACE Facility

- JES2 trace points for Performance info
  - ID 17 - Checkpoint
  - ID 20 - SYSOUT work selection
  - ID 30 - Posting for new work
  - ID 31 - JOB work selection

Sample usage:

- $T$ TRACEDEF,ACTIVE=YES, LOG=(START=YES)
- $S$ TRACE(17)
  - run test
- $P$ TRACE(17)
- $T$ TRACEDEF,SPIN
- $T$ TRACEDEF,ACTIVE=NO
Command Authorization

- **JES2 Command Authorities**
  - RDR/INTRDR: System, Device, Job
  - NODE: System, Network, Device, Job
  - JOBCLASS: ALL, SYS, IO, CONS, INFO

- **SAF/RACF OPERCMDS class**
  - If active, all JES2 commands protected by profiles:
    - general format structure is: jesx.verb.modifier
    - Required READ, UPDATE, CONTROL access depends on 'verb.modifier'

- **References:**
  - "JES2 Init & Tuning Guide" - Chapter 7
  - "JES2 Commands" - Each command shows "Authority Req'd"

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 $SLINE(*) command
JES2 System Automation

**JES2 already automates several functions**

- Set init parms to allow this to happen:
  - `MASDEF AUTOEMEM=ON, RESTART=YES`
  - `CKPTDEF NEWCKPTn=xxxx, OPVERIFY=NO`

**Common house-keeping chores . . .**

- Clean up old spool files:
  - `$P O JOBQ, /Q=S, /Days >4 /*Class S output */`
  - `$P JQ, /DAYS > 7 /* Jobs */`
  - `$T A, I=86400, '$PJQ, /DAYS > 7' /* Use Automatic Commands*/`

- Keep Lines started & Nodes connected:
  - `$T A SLNE, I=3599, '$SLINE(2-27)' /* Start all SNA Lines */`
  - `$T A SNL2, I=3600, '$SN,LINE2,N=WSCNEXT'`

Debugging

**Recognizing a Problem:**

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

**Diagnosis - Try these before you Need them:**

- Commands/Messages (eg, `$HASP088 ABEND Analysis`)
- `$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"
Resources

- **Education:**
  - System Operations for OS/390 (ES270 - Classroom)
  - others

- **z/OS Internet Library**

- **JES2 Library:**
  - Hard-copy, PDF
  - CDROM
  - BookManager

- **Other Operators, Systems Programmers**

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**OS/390 JES2 LIBRARY**

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Command Syntax in railroad track format

* Soft-copy only
Questions