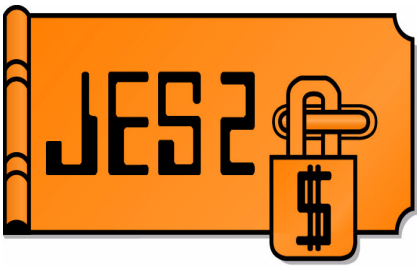
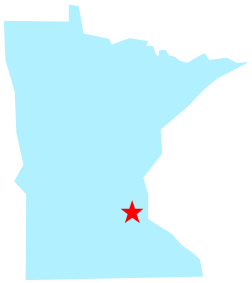


JES2 & WLM Initiators



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Chip Wood
JES2 Design/Development/Service
Poughkeepsie, NY

chipwood@us.ibm.com

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WLM Batch Initiator Support

- Batch Initiators may be managed by WLM on a job class basis
  - WLM determines how many initiators in each service class on each system
  - **JOBCLASS(x) MODE=WLM**
  - Jobs in WLM-mode job classes queued by WLM service class
- Traditional JES-managed initiators still exist but will not select from WLM job classes
  - Initiators controlled by operator/automation
  - **JOBCLASS(x) MODE=JES**

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JES vs. WLM initiators

- **JES initiators**:
  - Run under JES2
  - Consume job numbers
  - Select jobs from **MODE=JES** jobclass, based on job class in order of priority
  - Use $SI, $PI, $ZI, $TI to control (operator command or automation)
  - Call $EXIT 14 and 49
  - Run in goal mode or compatibility mode
- **WLM initiators**
  - Run under MASTER
  - Don't consume job numbers
  - Select jobs from **MODE=WLM** jobclass, based on service class in order of arrival time
  - Started and stopped by WLM based on goals and capacity
  - Call $EXIT 49 only
  - Run in goal mode only
  - $ACTIVATE required!

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Other differences

- To limit the systems on which jobs of a particular class can run:
  - **JES Initiators**
    - Start initiators for that class only on the desired systems
  - **WLM Initiators**
    - The scope of a service class is sysplex-wide
    - Jobs in a service class may be run wherever there is capacity
    - Use SYSAFF or SCHENV to limit the systems on which job can run

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Other differences

- To limit the number of jobs concurrently running in a particular job class:
  - **JES Initiators**
    - Start a limited number of initiators selecting that class
  - **WLM initiators**
    - WLM will continue to start initiators if there is work to do and capacity exists
    - Use job class limits to prevent additional jobs from running
    - **JOBCLASS XEQCOUNT=MAX=nn**
    - Also honored for JES initiators

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Other differences

- Jobs issue **$HASP373** message when selected for execution by an initiator
  - **JES Initiators**
    - **$HASP373** *jobname* **STARTED - INIT** *nnnn* **- CLASS** *class* **- SYS** *sys*
  - **WLM Initiators**
    - **$HASP373** *jobname* **STARTED - WLM INIT - SRVCLASS** *srvclass* **- SYS** *sys*

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Initiator commands

- **$DI**, **$TI**, **$PI**, **$SI**, **$ZI**
- Operate on JES controlled initiators only
- $SCAN driven as of R4
  - Initiators may be referenced by name or number (by default name=number)
    - Beware when using numerical names
  - Ranges work differently in R4 from prior releases
- Most operands may be used as filters
- **INELIGIBLE_CLASS** keyword displays classes from which work will not be selected because the job class is held or WLM-managed

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$SXEQ/$PXEQ

- **$P XEQ** prevents new jobs from entering execution on this MAS member
  - JES-managed initiators
  - WLM-managed initiators
  - **$HASP222** message displayed (highlighted) while in this state
- **$S XEQ** undoes **$P XEQ**
- Allows executing jobs to quiesce so system can (eventually) be shut down cleanly
- **$P/$PXEQ** status displayed on **$D MEMBER**

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$S J

- Schedules job for immediate execution
  - Pre-execution jobs only!
  - Job must be in WLM-mode job class, with WLM in GOAL mode
  - Job holds are released
  - Job class holds and limits are ignored
  - ★ As of OW38962, **$SJ** honored after **$PXEQ** when issued from $PXEQ'ed member
  - Designed for occasional use
- WLM selects system from list of systems where job is eligible to run, based on current workload
- WLM starts an initiator on that system specifically for this job

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Job Selection Exits

- **$EXIT 14** (existing exit)
  - **"QGET"** exit
  - Allows installation to replace job work select algorithm
  - Not called for WLM initiator selection
  - Must return an UPDATE mode JQA (**$QG2**)
- **$EXIT 49** (new exit)
  - **"QGOT"** exit
  - Allows installation choice to accept or reject selected job ("veto" exit)
  - Not called when **$EXIT 14** selects job
  - Input is an UPDATE mode JQA

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WLM Service Class

- Every job is classified and assigned to a WLM service class based on:
  - **Job class**
  - **Priority**
  - **Accounting information** from job card
  - **Performance group**
  - **Owning userid**
  - ➢ **Scheduling environment** as of OS/390 R10
  - ➢ **Node name** **(XCF group name)** as of OS/390 R10
- WLM Initiators select jobs from **MODE=WLM** job classes, based on their service class
  - WLM and JES mode job classes should not share service classes

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WLM Service Class *(continued)*

- **Prior to execution**
  - Service class determines how long until job is selected by a WLM initiator
  - Time job is eligible to run, but not selected, is tracked (Queue delay)
  - If goals are not being met, WLM may start more inits in a service class (based on capacity, defined goals, etc.)
- **During execution**
  - Service class determines how resources (such as CPU) are assigned to the running job
  - Applies to both WLM and JES mode jobs

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WLM Service Class *(continued)*

- Jobs in **MODE=WLM** job classes are queued within a service class in arrival time order
  - Priority affects which queue the job is on, but not its location within the queue
  - **$TJ,P=+nnn** does not make job the next to execute
    - Use **$SJ**, **$TJ,SRVCLASS=**, or make priority 15 its own SRVCLASS
- Priority aging:
  - Jobs in **MODE=JES** job classes are priority aged
    - Increase to next priority results in reclassification
  - Jobs in **MODE=WLM** job classes are **not** priority aged

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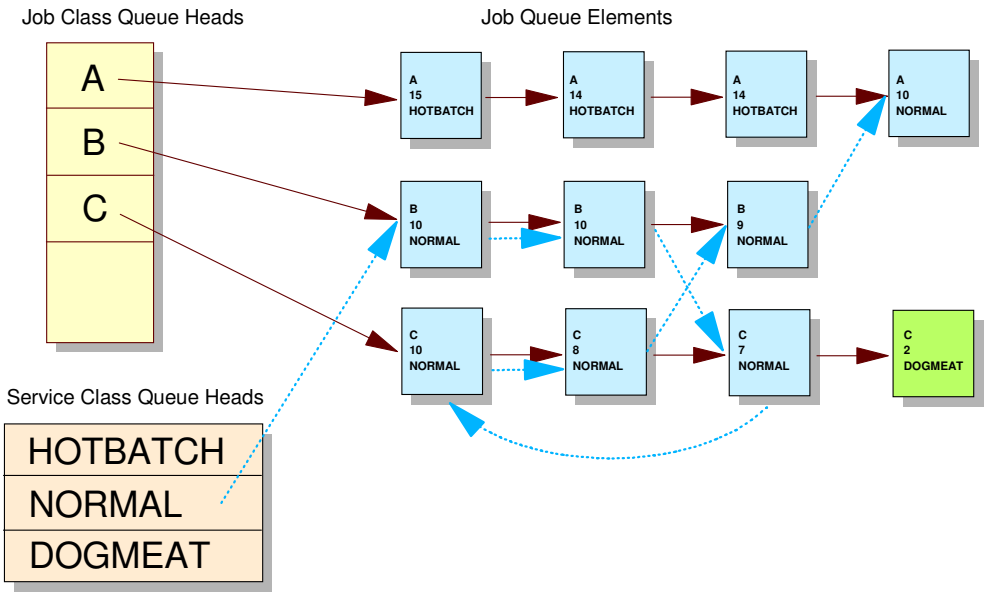
Service Class Queues



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Service class queues

- Use **$QJQE** macro to run service class queues
  - Returns JQAs for each job on queue

```
LABEL    $QJQE   SRVCLASS=(R2),     Points to service class
                 REG=(R6),          Return JQA addr in R6
                 MODE=READ,         Read mode only
                 LOOP=LBLLOOP,      Loop label (within macro)
                 NOMORE=LBLDONE     When out of jobs, go here

          USING  JQA,R6

*         Process job

          B      LBLLOOP            Loop for next job

LBLDONE   DS     0H                 Here when done
```

  - Can also pass WLM service class queue head obtained using the **$DOGWSCQ** macro

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Scheduling Environment

- A **Scheduling Environment** is a collection of resources in a particular state
- Schedules jobs on the right system at the right time
  - Similar to system affinity
- Specified via **// JOB SCHENV=**
- Defined and controlled by WLM
- Can be used by both WLM and JES mode jobs
- Displayable on **$D J** command for job
- SDSF display of all scheduling environments

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Scheduling Environment

- New function as of OW38962:
  - **JOBCLASS SCHENV=*xxxxxxx*** allows a default scheduling environment to be set for a job class
    - Default applied pre-conversion
    - Value overridden by **// JOB SCHENV=**
    - Value overridden by setting **JCTSCHEN** in RDR or CNVT exits (2, 3, 4, 20, 6, 44)
    - **$TJOB,CLASS=** does not reset the SCHENV if the job has already converted
  - **$T JOB,SCHENV=*xxxxxxx*** is now allowed

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Resources

- Resource Elements
  - Defined in WLM policy
  - 16 character name
  - 3 possible states
    - **ON**
    - **OFF**
    - **RESET**
    - **ON** and **OFF** are only states that can be scheduled
  - Known throughout sysplex
  - State on each system is independent of state on other systems
  - Change state via **F WLM,RESOURCE=*xxx*,ON/OFF**

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Scheduling Environments

- Scheduling environments
  - Defined in WLM policy
  - 16 character name
  - 32 character description
  - Composed of a group of resources in a specified state
    - Resources may be **ON** or **OFF,** but not **RESET**
  - Scheduling environment is available on any system where all of its resources are in the correct state.
  - Externally specified via **SCHENV** parameter on **JOB** card or via **$TJOB*nn*,SCHENV=**
    - May also be set in JES2 **$EXIT 2**, **3**, **4**, **20**, **6**, or **44** by filling in **JCTSCHEN**

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SDSF SE (Scheduling Environment) Panel

```
  Display  Filter  View  Print  Options  Help
-------------------------------------------------------------------------
 SDSF SCHEDULING ENVIRONMENT DISPLAY MAS SYSTEMS          LINE 1-9 (105)
 COMMAND INPUT ===>
 NP       SCHEDULING ENV    DESCRIPTION                    SYSTEMS
          DEFAULT           Default_Environment            AQTS,AQFT,AQTX,AQTY
          IMS_PROD          IMS_Production_Required        AQTS,AQFT
          IMS_PROD_A        IMS_Test_Required              AQTX,AQTY
 R        QAR_DB2_OFFSHIFT  QAR_DB2_Subsystem_Night        AQFT
          QAR_DB2_PRIME     QAR_DB2_Subsystem
          SAMS_APPLICATION  SAMS_Application_System        AQTS
          SAS_C_COMPILER    SAS_C_Compiler                 AQTX,AQTY
          SSAR_UTILITY      SSAR                           AQFT
          VECTOR_CHEAP      Default_Environment            AQTX
```

- Scope can be **MAS** or **ALL**
- No overtypes
- No JES2 Dependencies (available when down)
- Prefix character **R** - **RES** panel for this SCHENV
- Prefix character **ST** - **ST** panel for this SCHENV

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SDSF RES (Resource) Panel

```
  Display  Filter  View  Print  Options  Help
-------------------------------------------------------------------------
 SDSF RESOURCE DISPLAY ALL SYSTEMS QAR_DB2_OFFSHIFT      LINE 1-2  (2)
 COMMAND INPUT ===>
 NP       RESOURCE              REQSTATE  AQFT   AQTS   AQTX   AQTY
          SHIFT                 OFF       OFF    OFF    OFF    OFF
          TEST_DB2_SS_QAR       ON        ON     OFF    OFF    OFF
```

- Access from **SE** Panel using **R** prefix action
- One column per MVS system
- Scope can be **MAS** or **ALL**
- State of resource may be overtyped
- No JES2 Dependencies (available when down)

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SDSF RES (Resource) Panel

```
  Display  Filter  View  Print  Options  Help
-------------------------------------------------------------------------
 SDSF RESOURCE DISPLAY ALL SYSTEMS                        LINE 1-9  (15)
 COMMAND INPUT ===>
 NP       RESOURCE              AQFT    AQTS    AQTX    AQTY
          IDTF_SUBSYSTEM        ON      ON      ON      OFF
          IMS_PROD_SS           ON      ON      OFF     OFF
          IMS_TEST_SS           OFF     OFF     ON      ON
          SHIFT                 OFF     OFF     OFF     OFF
          SAS_C_COMPILER        RESET   OFF     ON      ON
          SYSTEM_AVAILABLE      ON      ON      ON      ON
          VECTOR_FACILITY       ON      ON      ON      OFF
          CHEAP_CYCLES          OFF     OFF     ON      ON
          DB2_PROD_SS_A         ON      OFF     OFF     OFF
```

- **RES** Panel to display all resources
- One column per MVS system
- Scope can be **MAS** or **ALL**
- State of resource may be overtyped
- No JES2 Dependencies (available when down)

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WLM Commands

- **D WLM**
  - Displays information about current policy, mode, etc.
- **D WLM,SCHENV=**
  - Displays information about a particular scheduling environment
- **D WLM,RESOURCE=**
  - Displays information about a particular resource
- **F WLM,RESOURCE=*xxx*,ON/OFF**
  - Alters the availability of a resource
- **Tip:** Use SDSF menus to display and modify scheduling environments and resources

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WLM Commands

- **F WLM,MODE=GOAL**
  - Puts WLM into GOAL mode
  - Goal mode and $ACTIVATE are required to run WLM initiators
  - Goal mode is NOT required to use scheduling environments, but there must be an active policy
- **F WLM,MODE=COMPAT**
  - Takes WLM out of GOAL mode
- **VARY WLM,POLICY=*xxxxxxxx***
  - Activates new WLM policy

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WLM Commands

- **RESET *jobname*,SRVCLASS=*xxxxx***
  - Modifies service class of executing job to *xxxxx*
  - WLM issues ENF 56, intercepted by JES
    - JES2 locates job, finds new service class via **SYSEVENT REQASD**, and sets JQAWSCN
- **$TJ(*jobname*),SRVCLASS=*xxxxx***
  - Modifies service class of pre-execution or executing job to *xxxxx*
  - JES2 routes command to correct member, which sets service class of executing job via **IWMRESET** macro

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JES2 Commands

- $D JOB displays
  - **SRVCLASS**
  - **SCHENV**
  - **SCHENV_AFF**
  - **DELAY**
- $T JOB modifies
  - **SRVCLASS**
  - **CLASS/PRIORITY**
    - Job is re-classified ($CLASSIF)
  - **SCHENV**
    - Job is re-classified (**OS/390 R10** only)

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$DJ, DELAY

- Delays reported on **$DJ,DELAY**
  - **HOLD** - job held via $HJ, $HA, TYPERUN=HOLD, duplicate job name, or JOBCLASS QHOLD=YES
  - **SYSAFF** - member job has SYSAFF to not available
  - **SCHENV** - scheduling environment not available
  - **MEMBER_STATUS** - SCHENV + SYSAFF + BOSS + $P + $PXEQ
  - **LIMIT** - JOBCLASS limit prevents job from starting
  - **LOCKED** - BERT lock is held somewhere
  - **BUSY_ON_DEVICE** - job is busy on a device
  - **SPOOLS_NOT_AVAILABLE**
  - **YES** - any of the above - filter only
  - **NO** - none of the above - filter only

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$DJ,DELAY

- Delays **NOT** reported on **$DJ,DELAY**
  - No JES2 initiators in job class on any system job can run on
  - No WLM initiators to select service class
    - Eventually, service class will no longer be meeting its goals and WLM may decide to start another init
  - Jobs are in MODE=WLM job classes but WLM is not in GOAL mode
  - All initiators are currently busy (normal queue delay)

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