JES2 Common Problems

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Overview

- What are the recurring questions that the service team keeps answering? We’re here to spread awareness of some scenarios which seem to keep popping up among our JES2 customers…
    - How does JES2 handle duplicate Jobs processing?
    - What is automatic checkpoint tuning?
    - How do I collect JES2 PERFDATA?
    - How do I respond to a $HASP263 or $HASP292 message?
    - How do I set up and use JES2EDS?

Duplicate Job Processing

- JES2 CPU consumption can increase due to duplicate jobs (batch jobs with the same JOBNAME) in the MAS if the job queues are structured in certain ways
- Duplicate jobs in and of themselves will not cause increased CPU consumption
- JES2 does not have an intrinsic problem with duplicate jobs, and there is no “limit” of duplicates above which we would expect performance degradation
- So why do customers keep encountering high CPU in JES2 when they submit large amounts of duplicate jobs?

Duplicate Job Processing

- How does JES2 handle duplicate jobs?
  - JOBDEF and/or JOBCLASS(x) DUPL_JOB parameter sets behavior:
    - NODELAY - multiple duplicates can execute at the same time
    - DELAY - only 1 job with a given name can be in execution at any time
  - JES2 must track which jobs are in execution and hold back duplicates when DELAY is coded
    - This has an associated CPU cost within $QGET

Duplicate Job Processing

- $QGET routine selects jobs to be placed into execution.
  - Works sequentially on a job queue – the more jobs we need to traverse to find a selectable job, the more CPU used
  - When DUPL_JOB=DELAY is coded, $QGET needs to skip over duplicate jobs if we know one of those jobs is currently in execution
  - Your queue composition matters
  - Other things that affect job selection:
    - SCHENV, SYSAFF, JOBCLASS XEQCOUNT, service class goals, available inits
    - All criteria needs to be checked in $QGET and this has an overhead cost
    - There are no job queue limits but everything has a cost

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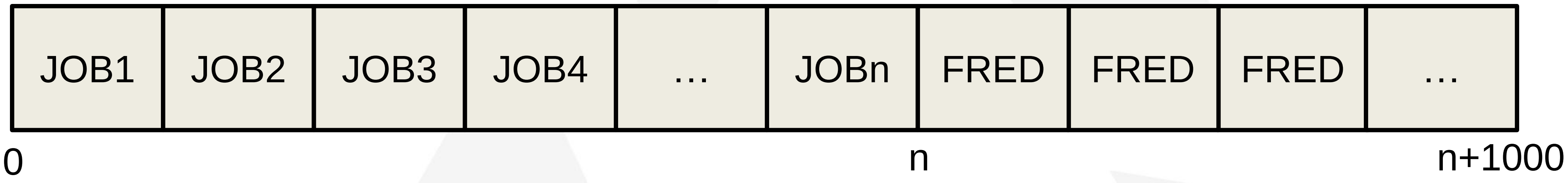
Duplicate Job Processing

- Scenario 1:
  - Job Queue for class A
  - DUPL_JOB=DELAY

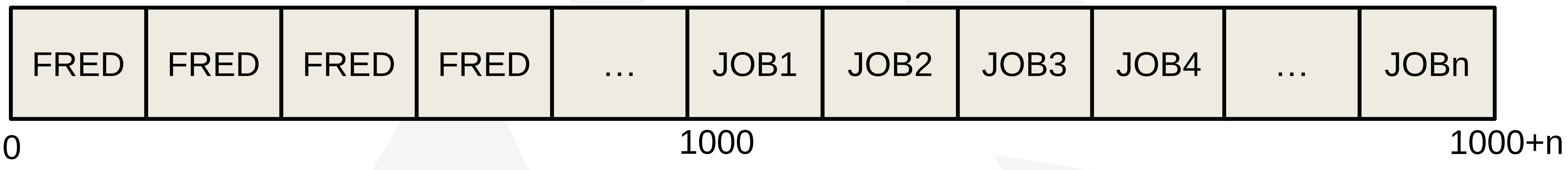


JOB1	JOB2	JOB3	JOB4	…	JOBn	FRED	FRED	FRED	…

- $QGET can choose non-duplicates right from the front of the queue
- Common when lots of dup jobs are dumped into a currently used job class

Duplicate Job Processing

- Scenario 2:
  - Job Queue for class A
  - DUPL_JOB=DELAY



FRED	FRED	FRED	FRED	…	JOB1	JOB2	JOB3	JOB4	…	JOBn

0

1000

1000+n

- Only 1 FRED job can execute at a time
- $QGET still traverses all FRED jobs before it can select a non-duplicate
- We'll constantly be running the chain looking for the next JOBn to run!

Duplicate Job Processing

- Scenario 3:
  - Two job classes: Class A for duplicates and Class B for non-duplicates

JOBCLASS(A)

FRED	FRED	FRED	FRED	…

JOBCLASS(B)

JOB1	JOB2	JOB3	JOB4	…

- $QGET is minimized because we will generally be pulling from the front of the queue
- Best case scenario to minimize duplicate job impact to non-duplicate work
- **Isolate your duplicate jobs!**

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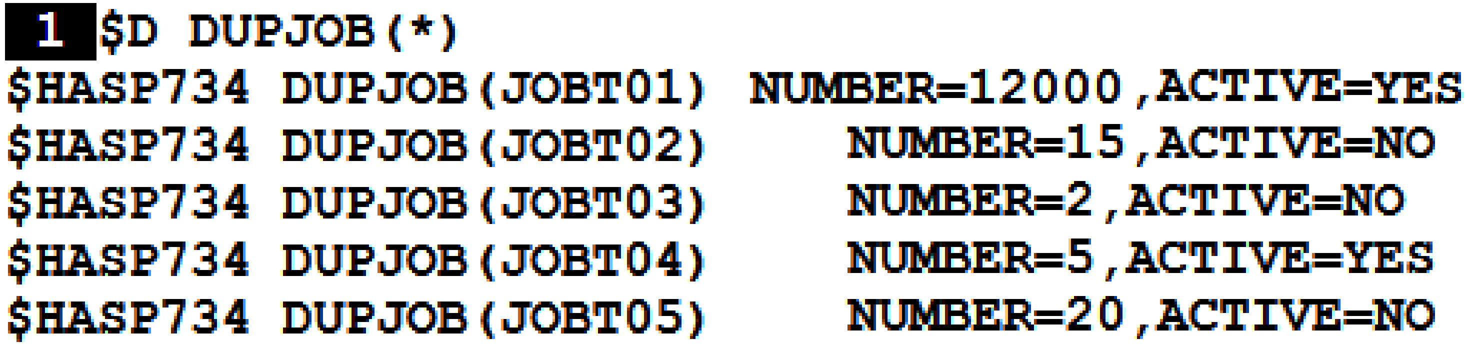
Duplicate Job Processing

- **My JES2 CPU usage is higher than normal. How can I tell if it is because of duplicate job processing?**
- This will manifest as CPU usage within the JES2 EXEC PCE
  - The EXEC PCE is in charge of putting jobs into and out of execution
  - JES2 PERFDATA will show where JES2 is using its CPU
    - We will demonstrate PERFDATA gathering a bit later

Duplicate Job Processing

- **How can I tell how many duplicate jobs are in my system?**
  - $D DUPJOB(*) or $D DUPJOB(nnnnnnnn)
  - Will display number of duplicates for all duplicate job families or a given job



```
 1 $D DUPJOB(*)
$HASP734 DUPJOB(JOBT01) NUMBER=12000,ACTIVE=YES
$HASP734 DUPJOB(JOBT02)     NUMBER=15,ACTIVE=NO
$HASP734 DUPJOB(JOBT03)     NUMBER=2,ACTIVE=NO
$HASP734 DUPJOB(JOBT04)     NUMBER=5,ACTIVE=YES
$HASP734 DUPJOB(JOBT05)     NUMBER=20,ACTIVE=NO
```

  - Here we see there are 12000 instances of JOBT01 and one of those jobs is currently executing (ACTIVE=YES)

Duplicate Job Processing

- **How can I get out of a high CPU condition?**
  - Use $D DUPJOB and PERFDATA to confirm a dup job issue
  - Cancel/purge the offending jobs ($CJ,P)
  - Rethink how you are submitting these jobs before you attempt them again
    - Should they run in a separated job class?
    - Can we restructure our job queues to reduce $QGET overhead?
- **Updates to $QGET tracing in V2R4**
  - New fields in JES2 trace 31 to give information on
    - Number of jobs skipped for duplicates
    - Number of jobs skipped for class limits
    - Number of times EXIT49 was called
    - Additional exit timing information

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JES2 Automatic Checkpoint Cycle Tuning

- The health of the CKPT cycle is crucial to JES2
- Customers can manually tune the CKPT cycle values for each of their members
    - MASDEF HOLD
        - Maximum time a MAS member can hold the ckpt lock
    - MASDEF DORMANCY
        - Minimum and max time a member can wait before requesting the ckpt lock
- In z/OS V2R2, we added automatic checkpoint tuning
- JES2 determines the optimum hold and dorm values for each member based on workload “pain”

JES2 Automatic Checkpoint Cycle Tuning

- Controlled by the MASDEF CYCLEMGT setting
  - Set in init deck or via $T MASDEF,CYCLEMGT=AUTO
- In AUTO mode, HOLD and DORMANCY cannot be changed by command
- $D MASDEF,HOLD,DORMANCY can still be used to monitor these parameters as they are changed by JES2
- All MAS members must be at V2R2 or higher for AUTO mode
- Toggling between AUTO and MANUAL is quick and easy
  - If you don't like the results, returning to manual is as simple as $T MASDEF,CYCLEMGT=MANUAL
- We'll revert to the previous HOLD/DORM right away

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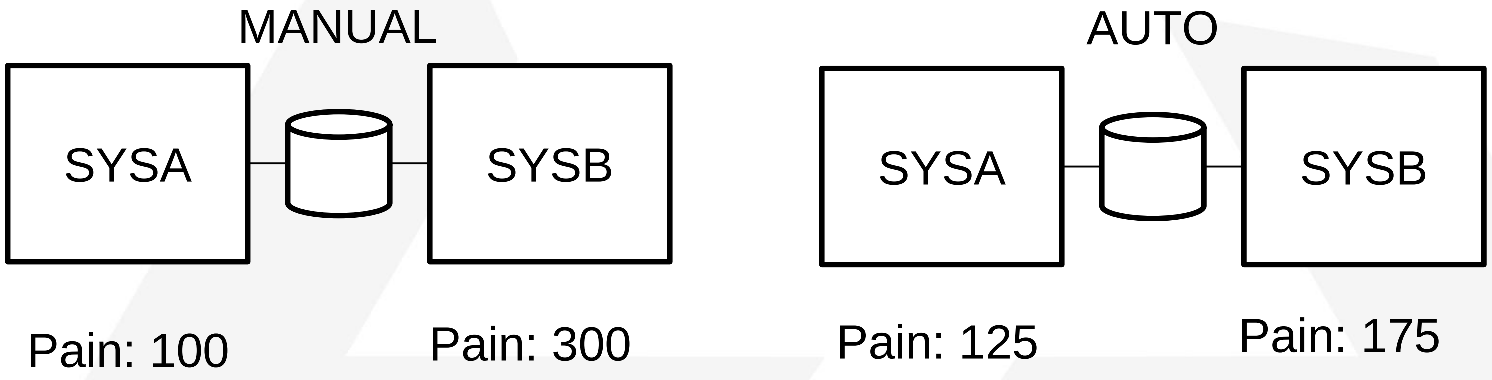
JES2 Automatic Checkpoint Cycle Tuning

- **So what is pain anyway?**
  - It is a measure of how much work is waiting for the checkpoint and how long it had to wait
  - Pain is reported in JES2 PERFDATA under CKPTSTAT heading
  - “Pain rate” multiplied by time a PCE spent waiting for CKPT ($QSUSE)
  - Some PCEs have a higher base pain rate
  - Pain means nothing in and of itself; it is only a metric for comparison
  - The goal of AUTO mode is to minimize pain **in the MAS**

JES2 Automatic Checkpoint Cycle Tuning

- **CYCLEMGT=AUTO caveats…**
  - AUTO will optimize the CKPT cycle for the entire MAS, not just for a specific member or application
  - This could be undesirable depending on your workload distribution
  - High pain might be tolerable on systems running lower priority work



MAS Pain went down – but SYSA Pain went up

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JES2 Automatic Checkpoint Cycle Tuning

- **Not all JES2 workload is created equal**
  - Prior to V2R4, SAPI workload may generate less pain than other JES2 work
  - A member processing SAPI workload with relatively little other JES2 work may not generate enough pain to compete with other members
  - Reorganizing your JES2 workload can improve overall pain levels
  - SAPI workload is being more heavily weighted starting in V2R4
  - The AUTO algorithm is always being improved
  - Your mileage may vary, but switching back to MANUAL is painless
    - Make sure everything passes the eyeball test – don’t rely only on pain numbers

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JES2 Perfdata – Overview

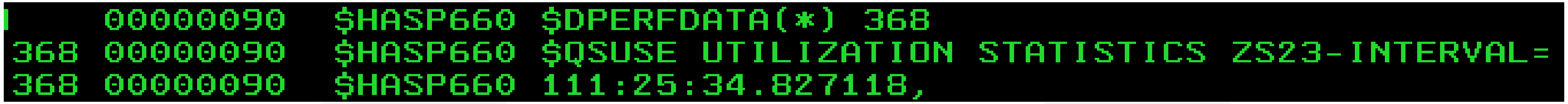
- JES2 is constantly collecting performance data in the background
  - No performance cost for gathering JES2 perfdata
- A summarized break down of CPU usage in various JES2 sub-components as well as things like CKPT cycle measurements
- Performance or high CPU issue? PERFDATA is a good place to start
- Likely to be requested by support if you open a service request
- Easy to collect – only requires a few console commands

JES2 Perfdata – Overview

- Always reset your perfdata interval before you begin data collection
  - $T PERFDATA(*),RESET
- To get a meaningful sample, collect data for 5-10 minutes (or as long as possible if the condition lasts for a shorter amount of time)
- To “collect” the perfdata, just use a display command to write to syslog
  - $D PERFDATA(*),L=Z
- It’s always best to collect more than one sample if possible
- Also, it’s good practice to collect samples under normal conditions for comparison

JES2 Perfdata – Tips and Tricks

- The perfdata interval – amount of time covered by the displayed statistics
- Perfdata is always being collected, so this is the time since the last refresh or JES2 restart
- If your system has been up for a while and you issue a perfdata display without doing a reset first, you’ll probably see something like this:

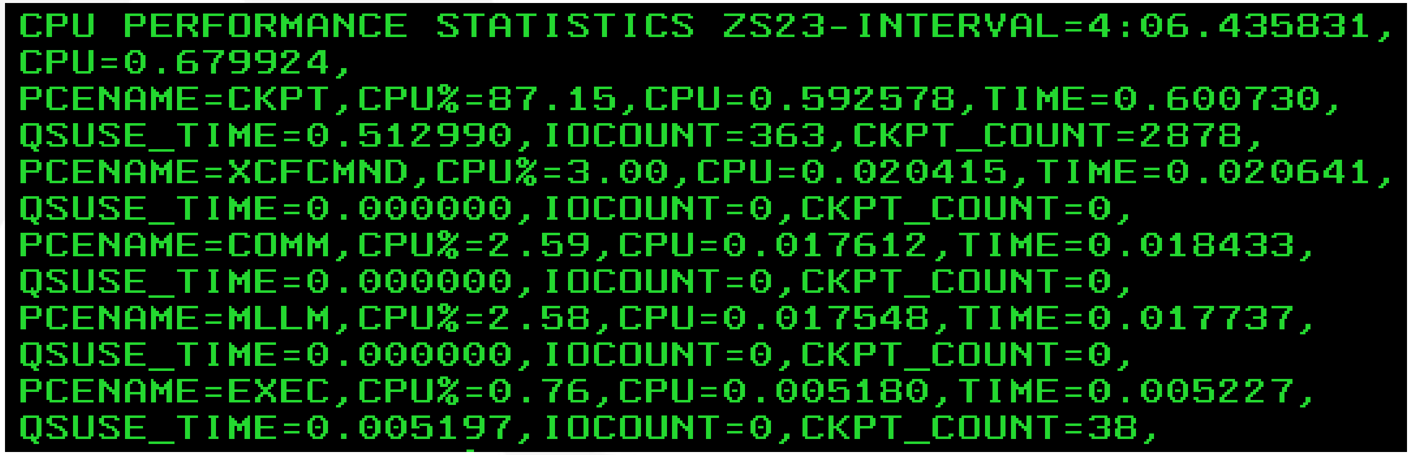


```
     00000090  $HASP660 $DPERFDATA(*) 368
368 00000090  $HASP660 $QSUSE UTILIZATION STATISTICS ZS23-INTERVAL=
368 00000090  $HASP660 111:25:34.827118,
```

- This means that the displayed data covers over 111 hours of JES2 activity. This is likely not useful data if your condition only lasted a few minutes

JES2 Perfdata – Tips and Tricks

- What does perfdata show us?
- CPU performance statistics
- High CPU usage in JES2 and EXEC PCE is largest consumer? Check your duplicate jobs.
- High usage in COMM? There may be a long running command
- HOPE PCE is very active? A SAPI application may be making a lot of requests

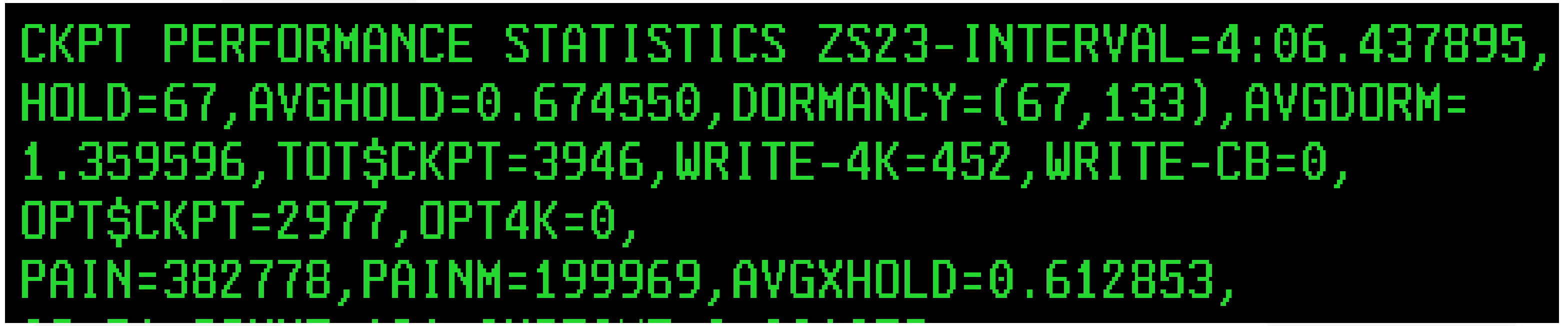


```
CPU PERFORMANCE STATISTICS ZS23-INTERVAL=4:06.435831,
CPU=0.679924,
PCENAME=CKPT,CPU%=87.15,CPU=0.592578,TIME=0.600730,
QSUSE_TIME=0.512990,IOCOUNT=363,CKPT_COUNT=2878,
PCENAME=XCFCMND,CPU%=3.00,CPU=0.020415,TIME=0.020641,
QSUSE_TIME=0.000000,IOCOUNT=0,CKPT_COUNT=0,
PCENAME=COMM,CPU%=2.59,CPU=0.017612,TIME=0.018433,
QSUSE_TIME=0.000000,IOCOUNT=0,CKPT_COUNT=0,
PCENAME=MLLM,CPU%=2.58,CPU=0.017548,TIME=0.017737,
QSUSE_TIME=0.000000,IOCOUNT=0,CKPT_COUNT=0,
PCENAME=EXEC,CPU%=0.76,CPU=0.005180,TIME=0.005227,
QSUSE_TIME=0.005197,IOCOUNT=0,CKPT_COUNT=38,
```

This system is mostly idle. Majority of CPU used by JES2 is for overhead of the CKPT cycle over a 4-minute interval

JES2 Perfdata – Tips and Tricks

- Checkpoint performance statistics
- Current hold and dorm settings as well as the actual average hold and average dormancy over the interval
- Total pain across the MAS as well as pain generated on this member (PAINM)
- AVGXHOLD – average excessive hold amount in seconds

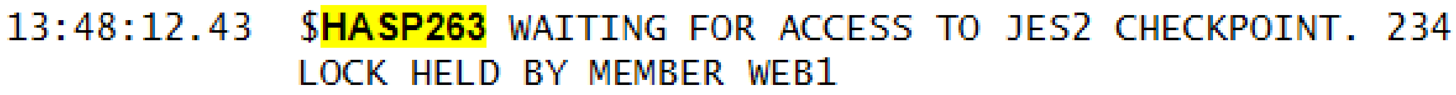


```
CKPT PERFORMANCE STATISTICS ZS23-INTERVAL=4:06.437895,
HOLD=67,AVGHOLD=0.674550,DORMANCY=(67,133),AVGDORM=
1.359596,TOT$CKPT=3946,WRITE-4K=452,WRITE-CB=0,
OPT$CKPT=2977,OPT4K=0,
PAIN=382778,PAINM=199969,AVGXHOLD=0.612853,
```

JES2 Perfdata – Usage Example

- JES2 CPU usage spikes / performance degrades every day at 2:00AM when our archiver program runs. What’s going on?
- Reset perfdata statistics when the issue occurs
    - Can use automated commands or operator input
- Gather 2-3 samples over 5-10 minutes during the condition (best case)
- Get a console dump of JES2
- When the condition clears, get another set of perfdata samples for comparison
- Getting good perfdata is a must-gather for IBM to diagnose performance issues

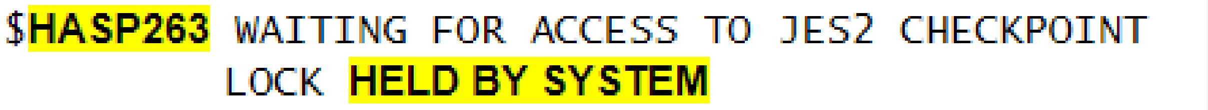
$HASP263



```
13:48:12.43   $HASP263 WAITING FOR ACCESS TO JES2 CHECKPOINT. 234
              LOCK HELD BY MEMBER WEB1
```

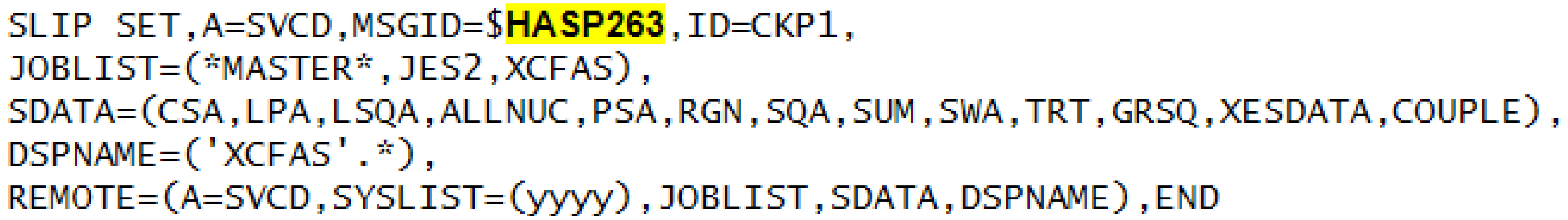
- First flavor of $HASP263 message – member issuing the message waited for the lock longer than the MASDEF LOCKOUT, which is held by another member of the MAS
- The system issuing the message is a victim in this case
- Need diagnostics of WEB1 in order to determine why it won’t give up the lock
- SLIP dump of MSGID $HASP263 is not good enough
- We require a dump of the system holding the lock, not the system issuing the message
  - Can set a MSGID SLIP to trigger remote dump of all other systems in the MAS
  - Generally, we won’t know who will be responsible until the message is issued
  - SLIP would need to be set on all members if we don’t know who will be affected

$HASP263



```
$HASP263 WAITING FOR ACCESS TO JES2 CHECKPOINT
         LOCK HELD BY SYSTEM
```

- Second flavor of $HASP263 message – member issuing the message waited for the lock longer than the MASDEF LOCKOUT, but we are unable to determine where the lock is held
- The system issuing the message is still a victim – but the culprit has changed
- This message indicates that our system did not get a response from XCF when we asked who held the lock
- Again, MSGID SLIP for $HASP263 is not good enough, need remote dump of all other members including XCF and it’s associated dataspace



```
SLIP SET,A=SVCD,MSGID=$HASP263,ID=CKP1,
JOBLIST=(*MASTER*,JES2,XCFAS),
SDATA=(CSA,LPA,LSQA,ALLNUC,PSA,RGN,SQA,SUM,SWA,TRT,GRSQ,XESDATA,COUPLE),
DSPNAME=('XCFAS'.*),
REMOTE=(A=SVCD,SYSLIST=(yyyy),JOBLIST,SDATA,DSPNAME),END
```

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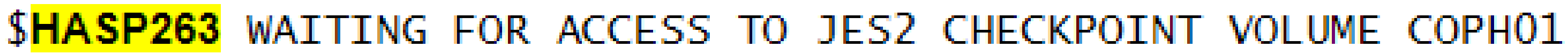
$HASP263



```
$HASP263 WAITING FOR ACCESS TO JES2 CHECKPOINT VOLUME COPH01
```

- Third flavor of $HASP263 message – member issuing the message cannot get access to the DASD volume which houses the CKPT (MASDEF LOCKOUT exceeded)
- Likely that some other application is obtaining a lock on the volume
- We recommend keeping the CKPT dataset on its own dedicated volume
- Can also occur if a mirroring/backup application is trying to back up the CKPT volume
- Also, possible I/O problem, other messages may be issued

$HASP263

- $HASP263 is often accompanied by other messages on other MAS members which more directly indicate the problem
  - **$HASP9203** – LONG PCE DISPATCH
    - This member of the MAS is busy doing some kind of JES2 processing
  - **$HASP9207** – JES CKPT LOCK HELD
    - This member is holding the lock longer than it should
  - **$HASP9211** – JES2 MAIN TASK NOT RUNNING
    - Something is preventing JES2 from being dispatched by MVS
    - Most often a lack of available CPU
  - **$HASP9213** – LONG JES2 COMMAND PROCESSING
    - JES2 is busy trying to process an operator command

$HASP263 – Summary

- The MAS member issuing $HASP263 is a victim
- A dump of the member issuing $HASP263 is not enough to find root cause
- You must gather a dump of the system holding the JES2 CKPT lock
    - Either trigger remote dumps on other MAS members when you see $HASP263
            - OR
    - MSGID SLIPs for related messages on the systems holding the lock
        - $HASP9203, $HASP9207, $HASP9211, $HASP9213

JES2EDS – What is it?

- JES2 V2R3 introduced the JES2 Email Delivery Service – JES2EDS
- Ability to notify a TSO user or email account when a job completes
- Works using the //NOTIFY= statement
- Multiple software pre-requisites
    - OMVS, TCPIP, zOSMF
    - JES2 uses the z/OS Web Enablement Toolkit to communicate with zOSMF
    - zOSMF accesses its configured SMTP server to actually send the emails
- Support team receives many questions regarding setup

JES2EDS – Setup FAQs

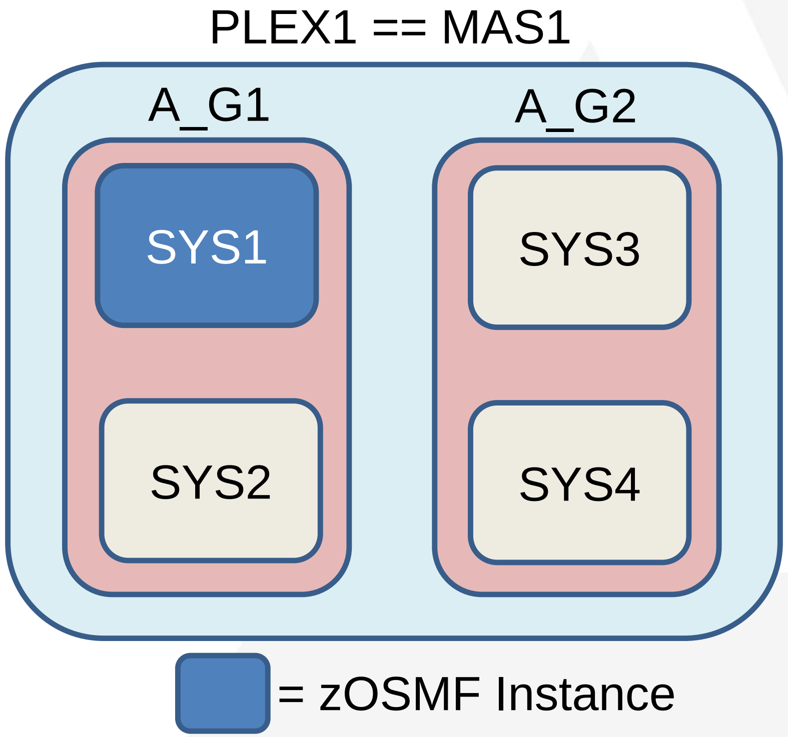
- Setup guide - https://ibm.biz/BdZSVT
- Assign a user ID to the JES2 EDS address space
    - Specified either by creating a profile in the STARTED class that matches the JES2 EDS address space name, or by adding an entry in the started procedures table (ICHRIN03)
    - For ease of setup, best for associated USERID to be JES2 subsystem user ID
- Keyring/Cert creation is straight forward for a default configuration
- A few small caveats:
    - The keyring must be named JES2EDS, there is no way to reconfigure this
    - Opening the keyring uses r_datalib SAF callable service GetRingInfo
    - Top Secret Security is missing this implementation without **PTF SO06741**
    - You must apply this PTF to use JES2EDS with TSS

JES2EDS – Setup FAQs

- Step 6: “*Add the user identifier that is configured in step 1 to the z/OSMF configuration as a valid z/OSMF user*” – what does this really mean?
- The userID associated with JES2EDS needs to be given the same authorizations as a normal zOSMF end user.
- Easiest way to do this is to add EDS userID to the IZUUSER RACF group
- No groups? Treat EDS userID as if it were a new user to zOSMF
  - zOSMF security requirements: https://ibm.biz/BdzK2Q

JES2EDS – Setup FAQs

- How do I tell JES2EDS which zOSMF server to communicate with?
  - JES2EDS finds the zOSMF server automatically – not configurable
  - The zOSMF server needs to be accessible to JES2EDS in the same zOSMF AUTOSTART_GROUP (set in IZUPRM) to be discoverable



- One zOSMF instance in the plex, running on SYS1, in autostart group A_G1
- EDS services available on SYS1 and SYS2
- JES2 in SYS3 and SYS4 will not be able to connect to the zOSMF instance
- Manually start a zOSMF instance in A_G2 or merge into one autostart group

JES2EDS – Setup FAQs

- JES2EDS ASID is starting but I don’t want to use it.
  - The ASID will be started when a job with NOTIFY= keyword completes
  - Or at JES2 start if there is an email stored on SPOOL waiting to be sent
  - There is currently no “clean” way to shut down only the JES2EDS ASID without shutting down JES2 entirely
  - There is no toggle to disable JES2EDS features
  - If you do not want JES2EDS ASID starting on your system, you will need to restrict the //NOTIFY= statement
  - Email queues can be purged with $PS($EDSQnnn)
  - You can display your queues with $DS($EDSQ*)
  - $PS($EDSQnnn),ONERROR – only purge messages with a delivery error

Questions?