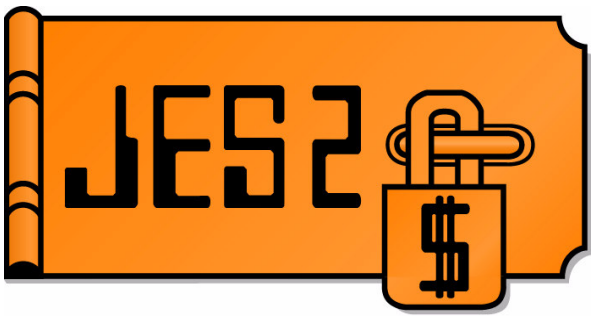

Improve JES2 Performance Using Trace Records

SHARE Winter 2001, Session: 2658

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- This presentation describes various JES2 trace records and how to use them to improve overall JES2 performance. It is assumed that you are familiar with JES2 and have a knowledge of the JES2 $TRACE facility.
- This presentation was created using examples from the OS/390 release 10 level of JES2. Some differences may exist in older levels of JES2.

Overview

This presentation will cover the following:

- Quick overview of the JES2 $TRACE facility
- Relevant trace record information
  - ID 17 - Checkpoint
  - ID 20 - SYSOUT work selection
  - ID 30 - Posting for new work
  - ID 31 - JOB work selection
  - Others
- Putting it all together

$TRACE overview

- Formatted trace data written to SYSOUT data set
- TRACEDEF sets up environment
  - PAGES= and TABLES= set up ECSA buffers
    - PAGES= is init deck only
  - ACTIVE= turns tracing on and off (YES/NO)
  - LOG= controls SYSOUT data set
    - START=YES/NO controls writing to DS
    - CLASS= sets SYSOUT class
    - SIZE= Controls records before SPIN

$TRACE overview *(continued)*

- TRACE(n) controls individual IDs
  - START=YES/NO turns an ID on or off
- PCEs/Devices can have selective tracing
  - TR or TRACE=YES/NO controls device
- Trace data sets can be spun at any time
  - $TTRACEDEF,SPIN

Turning on a trace and create SYSOUT

- $T TRACEDEF,ACTIVE=YES, LOG=(START=YES)
- $STRACE(17)

run test

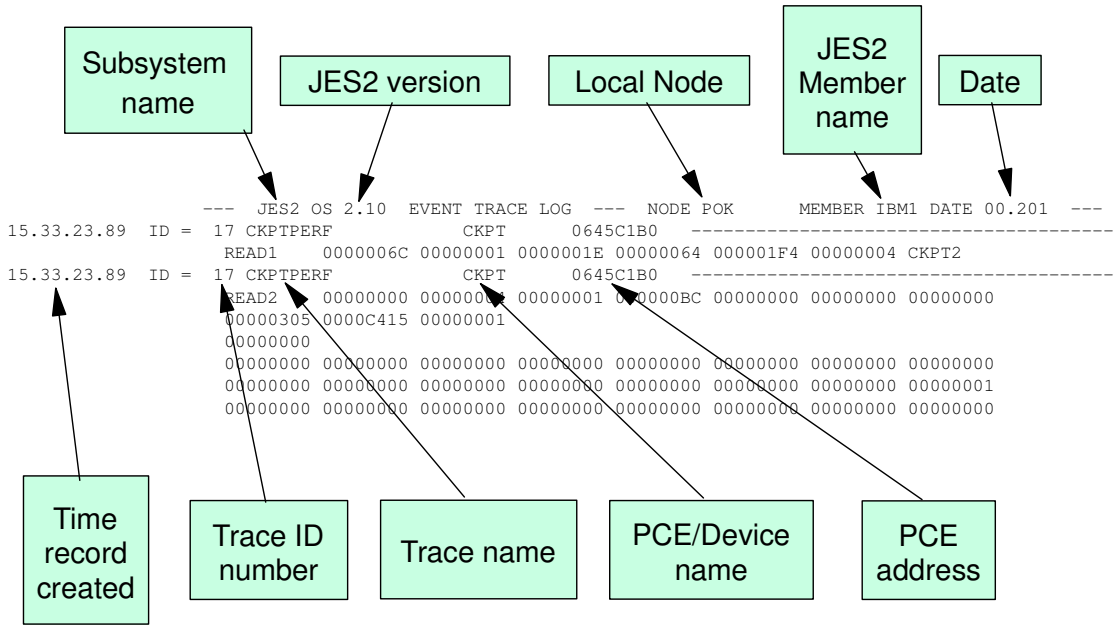
- $PTRACE(17)
- $T TRACEDEF,SPIN
- $T TRACEDEF,ACTIVE=NO

$TRACE output

- SPIN SYSOUT data set created
  - JOBNAME is $TRCLOG
  - This is an STC
  - SYSOUT class is as specified on TRACEDEF

```
$HASP686 OUTPUT($TRCLOG)    OUTGRP=1.1.1,BURST=NO,FCB=****,
$HASP686                    FLASH=****,FORMS=STD,HOLD=(NONE),
$HASP686                    OUTDISP=WRITE,PRIORITY=144,
$HASP686                    PRMODE=LINE,QUEUE=A,
$HASP686                    RECORDS=(91 OF 91),ROUTECDE=LOCAL,
$HASP686                    SECLABEL=,TSOAVAIL=NO,UCS=****,
$HASP686                    USERID=IBMUSER,WRITER=
```

$TRACE Output *(continued)*



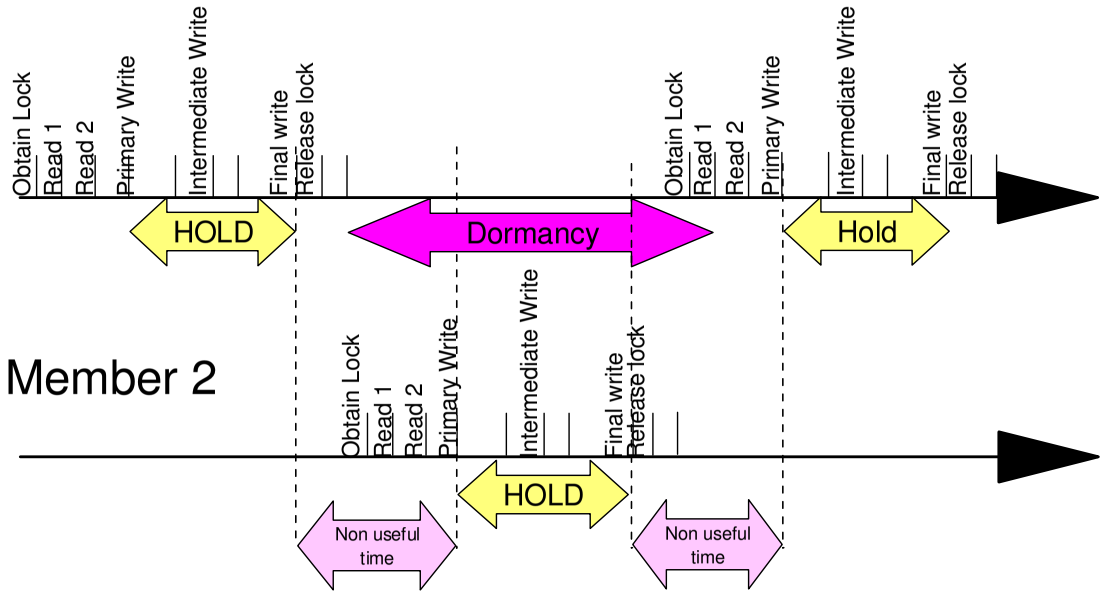
How can $TRACE help me?

- Watch for unusual trace results
- Look for trends over time
- See how load affects trace data
- This implies looking at your system when there is no problem and setting up a baseline
- See how changes to the system affect trace output
- Look for problems before the effect is noticed

Trace 17 - Checkpoint

- This traces all CKPT I/O and reports various data
- Reduction program JES2T17A in SHASSAMP
- Most useful in an MAS
- Tuning knobs that this can help with
  - MASDEF HOLD= and DORMANCY=

The Checkpoint Cycle



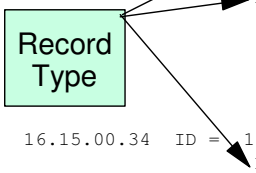
Trace 17 - Checkpoint *(continued)*

- Goal in tuning
  - Reduce MAS performance penalty
  - Functions in MAS are delayed waiting for checkpoint
  - Impact of delay can be reduced by parallel processing
    - Parallel processing example - use multiple internal readers to submit jobs instead of a single internal reader
  - CKPT tuning can also reduce delays

Trace 17 - Checkpoint *(continued)*

- Goals in tuning (continued)
  - Balancing act between
    - Reduce time to reacquire checkpoint
    - Hold long enough to not create additional delays
    - Keep non-useful time in CKPT cycle short
  - Trace 17 and its reduction program helps adjust the balance

Sample TRACE 17




```
16.15.00.25  ID =  17 CKPTPERF            CKPT      0645C1B0   ------------------------------
                   READ1    0000006E 00000003 0000001E 00000064 000001F4 00000004 CKPT2
16.15.00.26  ID =  17 CKPTPERF            CKPT      0645C1B0   ------------------------------
                   READ2    00000000 00000004 00000087 000000BC 00000006 000027AD 000023B7
                   00002F9C 00002886 0000000C
                   0053B510
                   00000000 0000000A 00000000 00000000 00000000 00000006 00000000 0000001A
                   00000000 00000014 00000000 00000007 00000000 0000000E 00000000 00000002
                   00000000 00000032 00000000 00000000 00000000 00000000 00000000 00000000
16.15.00.34  ID =  17 CKPTPERF            CKPT      0645C1B0   ------------------------------
                   PRIMARY  00000342 00000000 00000000 000000BC 00000001 0000030E 0000030E
                   00000000          00000000 0000000C 00004265 CKPT1
                   00000000 00000000 00000000
                   00000001 00000000 00000000 00000000 00000001 00000000 00000002 00000000
                   00000002 00000000 00000001 00000000 00000001 00000000 00000001 00000000
                   00000003 00000000 00000000 00000000 00000000 00000000 00000000 00000000
16.15.00.38  ID =  17 CKPTPERF            CKPT      0645C1B0   ------------------------------
                   INTERMED 000001B7 00000002 0000002C 000000BC 00000001 000000C8 000000C8
                   000011AB          00000001 0000000C 00004266 CKPT1
                   0000009D 00013605 00000ED6
                   00000000 00000002 00000000 00000000 00000000 00000002 00000000 00000009
                   00000000 00000006 00000000 00000002 00000000 00000005 00000000 00000001
                   00000000 00000011 00000000 00000000 00000000 00000000 00000000 00000000
16.15.00.62  ID =  17 CKPTPERF            CKPT      0645C1B0   ------------------------------
                   FINAL    000000AD 00000002 00000010 000000BC 00000000 00000000 00000000
                   00002406 00000DCB          00000001 00000007 00004268 CKPT1
                   0000012B 00044BFB 0000274D
                   00000000 00000004 00000000 00000000 00000000 00000004 00000000 00000012
                   00000000 0000000E 00000000 00000004 00000000 0000000B 00000000 00000002
                   00000000 00000021 00000000 00000000 00000000 00000000 00000000 00000000
```

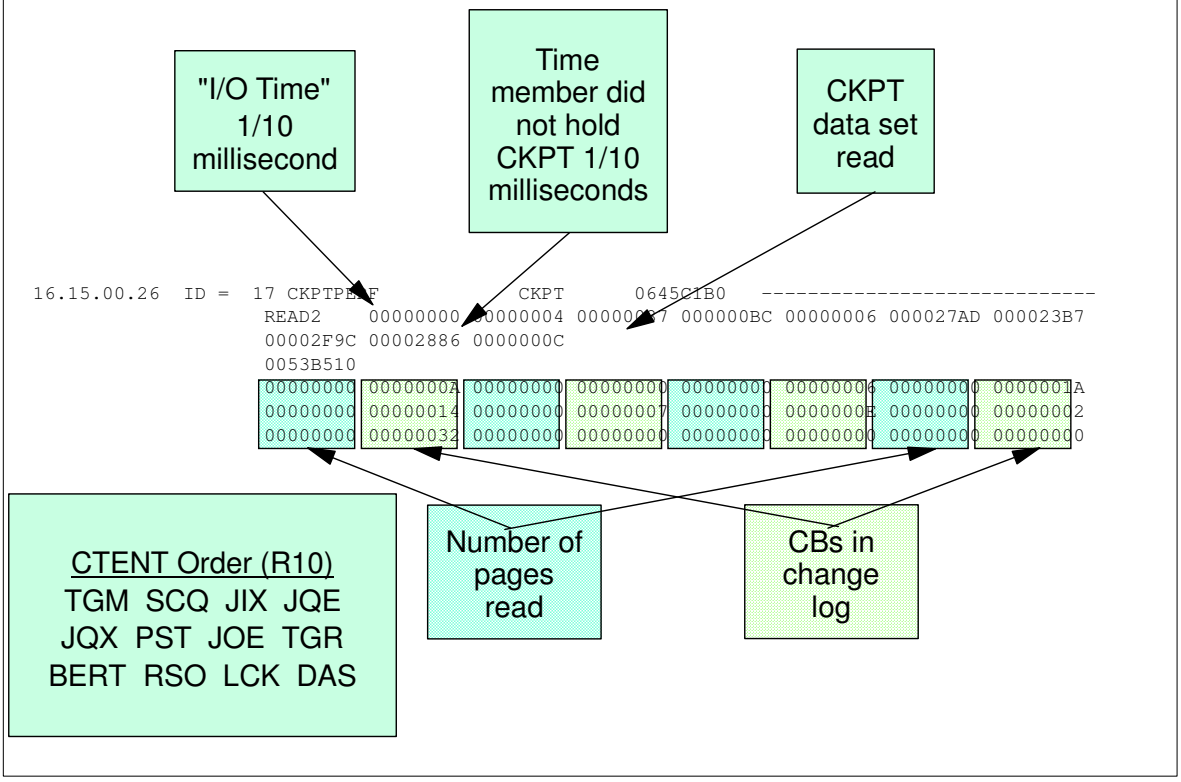
Sample TRACE 17 - READ1

```
16.15.00.25  ID =  17 CKPTPERF            CKPT      0645C1B0   ------------------------------
                   READ1    0000006E 00000003 0000001E 00000064 000001F4 00000004 CKPT2
```

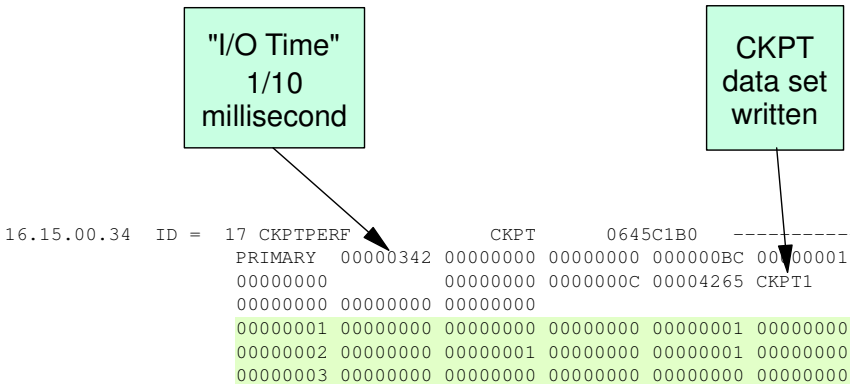
"I/O Time" 1/10 millisecond

CKPT data set read

Sample TRACE 17 - READ2

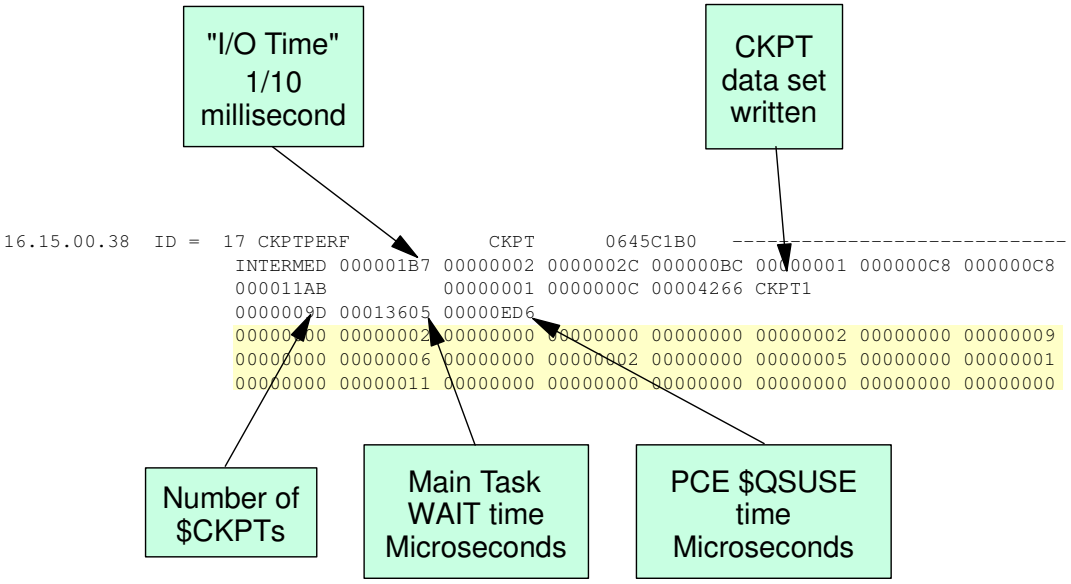


Sample TRACE 17 - PRIMARY

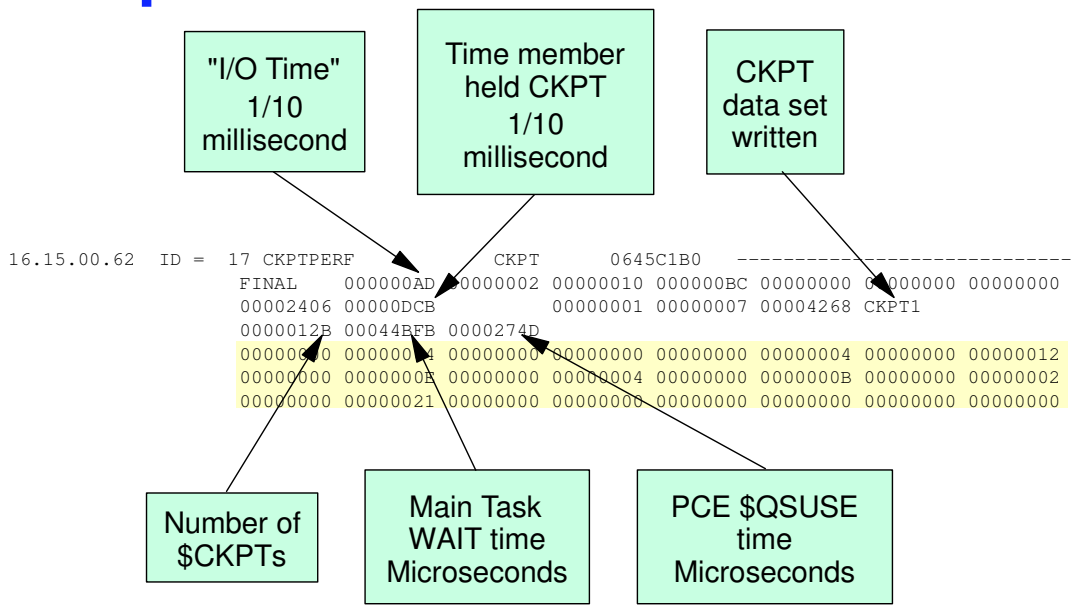



```
16.15.00.34  ID =  17 CKPTPERF           CKPT      0645C1B0   ------------------------------
                 PRIMARY  00000342 00000000 00000000 000000BC 00000001 0000030E 0000030E
                 00000000          00000000 0000000C 00004265 CKPT1
                 00000000 00000000 00000000
                 00000001 00000000 00000000 00000000 00000001 00000000 00000002 00000000
                 00000002 00000000 00000001 00000000 00000001 00000000 00000001 00000000
                 00000003 00000000 00000000 00000000 00000000 00000000 00000000 00000000
```

Sample TRACE 17 - INTERMED



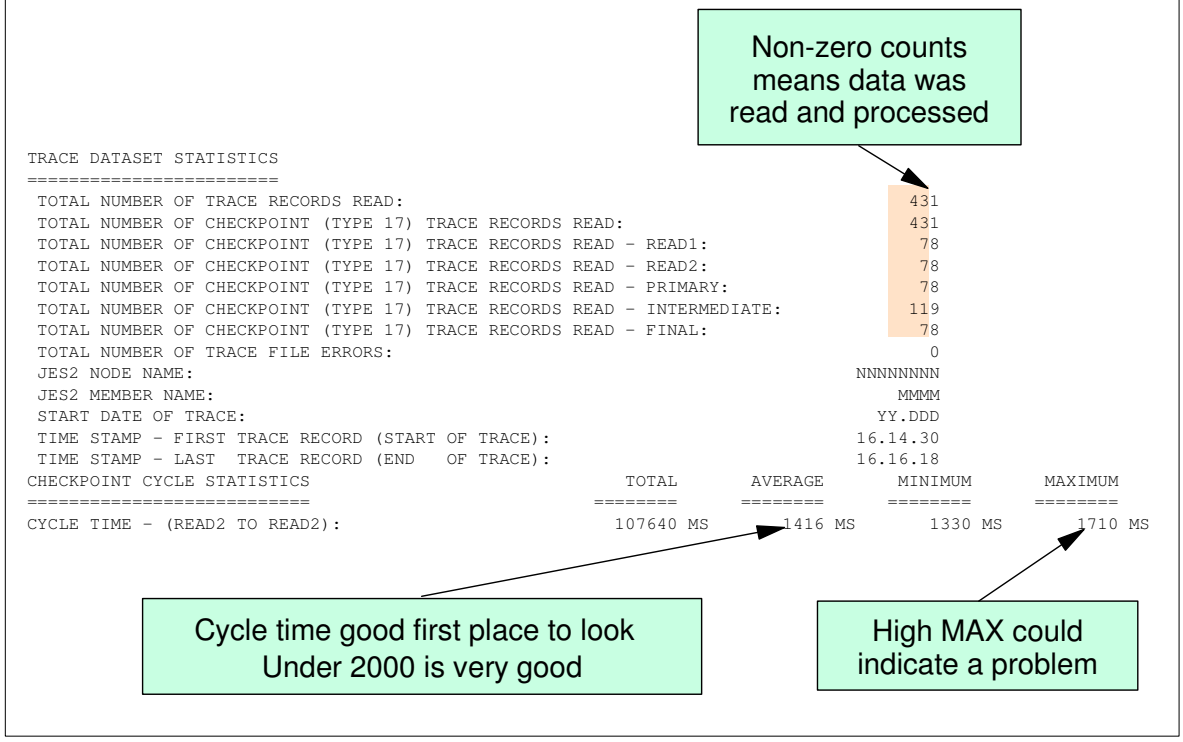
Sample TRACE 17 - Final



Trace 17 Reduction Program

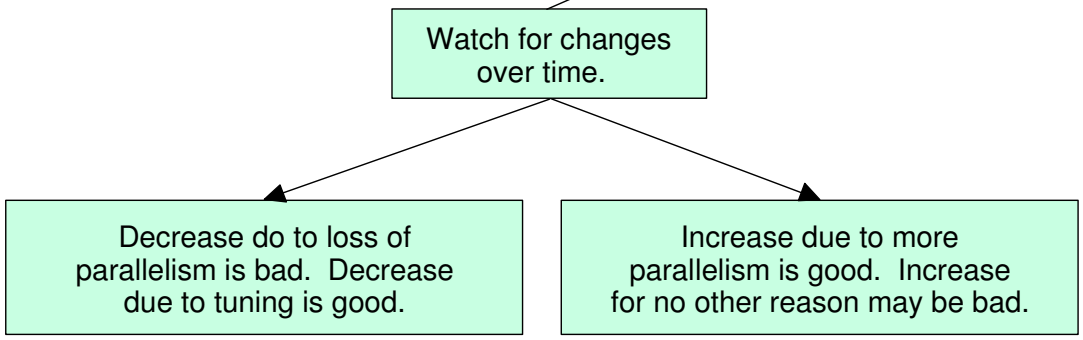
- Summarizes trace 17 data
  - JES2T17A in SHASSAMP
  - Normal way to look at trace data
  - Useful for trend analysis
  - See prolog for how to run

Trace 17 Reduction Program

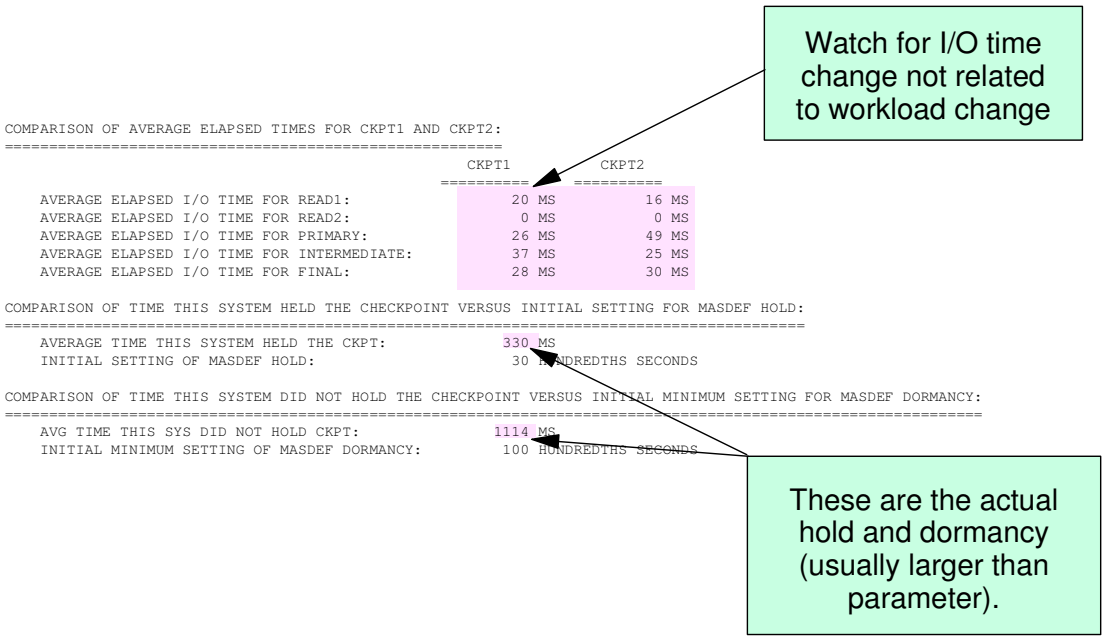


Trace 17 Reduction Program

READ2 STATISTICS	TOTAL	AVERAGE	MINIMUM	MAXIMUM
NUMBER OF PCES $WAITING FOR ACCESS TO CHECKPOINT:	405	5	2	9
MAX TIME PCE $WAITING FOR ACCESS TO CHECKPOINT:	78226 MS	1003 MS	12 MS	1221 MS
AVG TIME PCE $WAITING FOR ACCESS TO CHECKPOINT:	70986 MS	910 MS	10 MS	1115 MS



Trace 17 Reduction Program

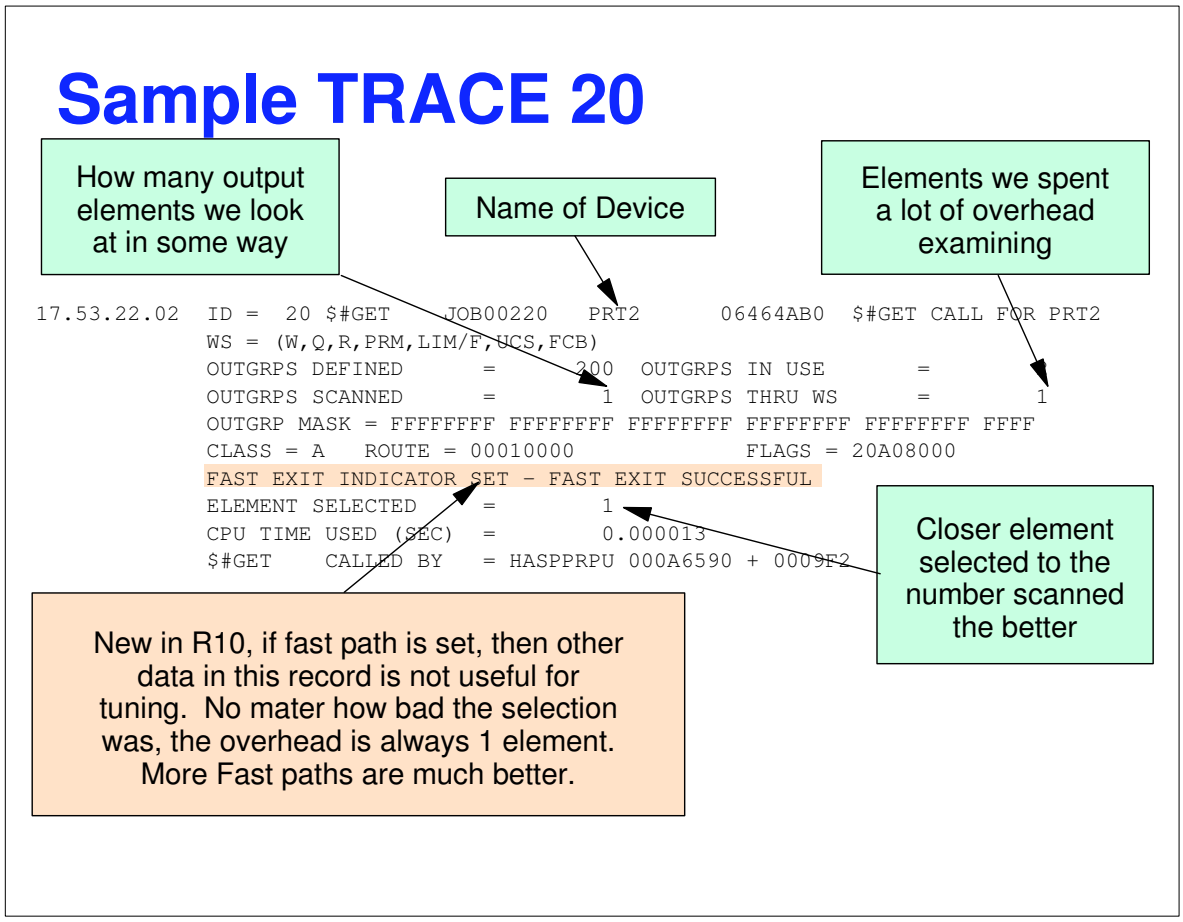



```
COMPARISON OF AVERAGE ELAPSED TIMES FOR CKPT1 AND CKPT2:
========================================================
                                              CKPT1          CKPT2
                                           ==========     ==========
    AVERAGE ELAPSED I/O TIME FOR READ1:          20 MS          16 MS
    AVERAGE ELAPSED I/O TIME FOR READ2:           0 MS           0 MS
    AVERAGE ELAPSED I/O TIME FOR PRIMARY:        26 MS          49 MS
    AVERAGE ELAPSED I/O TIME FOR INTERMEDIATE:   37 MS          25 MS
    AVERAGE ELAPSED I/O TIME FOR FINAL:          28 MS          30 MS

COMPARISON OF TIME THIS SYSTEM HELD THE CHECKPOINT VERSUS INITIAL SETTING FOR MASDEF HOLD:
==========================================================================================
    AVERAGE TIME THIS SYSTEM HELD THE CKPT:          330 MS
    INITIAL SETTING OF MASDEF HOLD:                   30 HUNDREDTHS SECONDS

COMPARISON OF TIME THIS SYSTEM DID NOT HOLD THE CHECKPOINT VERSUS INITIAL MINIMUM SETTING FOR MASDEF DORMANCY:
==============================================================================================================
    AVG TIME THIS SYS DID NOT HOLD CKPT:            1114 MS
    INITIAL MINIMUM SETTING OF MASDEF DORMANCY:      100 HUNDREDTHS SECONDS
```

Trace 20 - SYSOUT work selection

- Traces most calls to select SYSOUT for processing
  - Printer/Punch, SAPI, NJE, RJE, Offload
  - NOT PSO, External Writer
- Displays selection criteria
- Reports overhead of selection
- Used to determine efficiency of setup
- Tuning knobs that this can help with
  - WS= on devices
  - SYSOUT processing philosophy

Sample TRACE 20



Sample TRACE 20

2 characters in Outgrp mask correspond to one element in WS=. Priority counts as 2 places.

```
17.55.48.42  ID =  20 $#GET    JOB00286   PRT2      06464AB0  $#GET CALL FOR PRT2
             WS = (W,Q,R,PRM,LIM/F,UCS,FCB)
             OUTGRPS DEFINED      =      200  OUTGRPS IN USE       =       77
             OUTGRPS SCANNED      =        2  OUTGRPS THRU WS      =        1
             OUTGRP MASK = FFFEFFFF FFFFFFFF FFFFFFFF FFFFFFFF FFFFFFFF FFFF
             CLASS = A    ROUTE = 00010000             FLAGS = 20A00000
             ELEMENT SELECTED     =        2
             CPU TIME USED (SEC)  =        0.000020
             $#GET    CALLED BY   = HASPPRPU 000A6590 + 0009F2
```

A value that is not FF indicates what WS value may have caused extra elements to be scanned. In this case, the printer was set to QUEUE=1A2B3C4D5E6F7G8 and the output selected was class A (second in the list).

Sample TRACE 20

These entries actually selected output. However, do not forget to look at entries that do NOT select any output (Element selected = 0). The cost of these are often greater than the cost to select output.

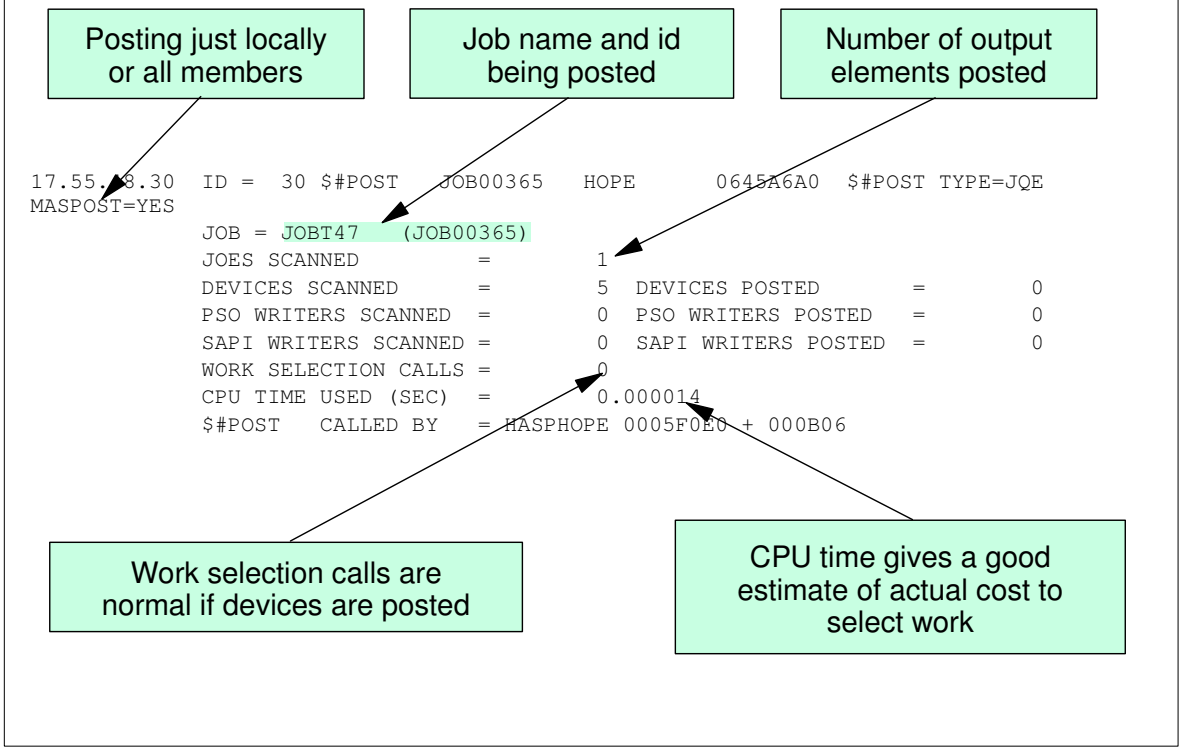
```
17.55.48.42  ID =  20 $#GET    JOB00286   PRT2      06464AB0  $#GET CALL FOR PRT2
             WS = (W,Q,R,PRM,LIM/F,UCS,FCB)
             OUTGRPS DEFINED      =      200  OUTGRPS IN USE       =       77
             OUTGRPS SCANNED      =        2  OUTGRPS THRU WS      =        1
             OUTGRP MASK = FFFEFFFF FFFFFFFF FFFFFFFF FFFFFFFF FFFFFFFF FFFF
             CLASS = A   ROUTE = 00010000                FLAGS = 20A00000
             ELEMENT SELECTED     =        2
             CPU TIME USED (SEC)  =        0.000020
             $#GET    CALLED BY   = HASPPRPU 000A6590 + 0009F2
```

CPU time gives a good estimate of actual cost to select work

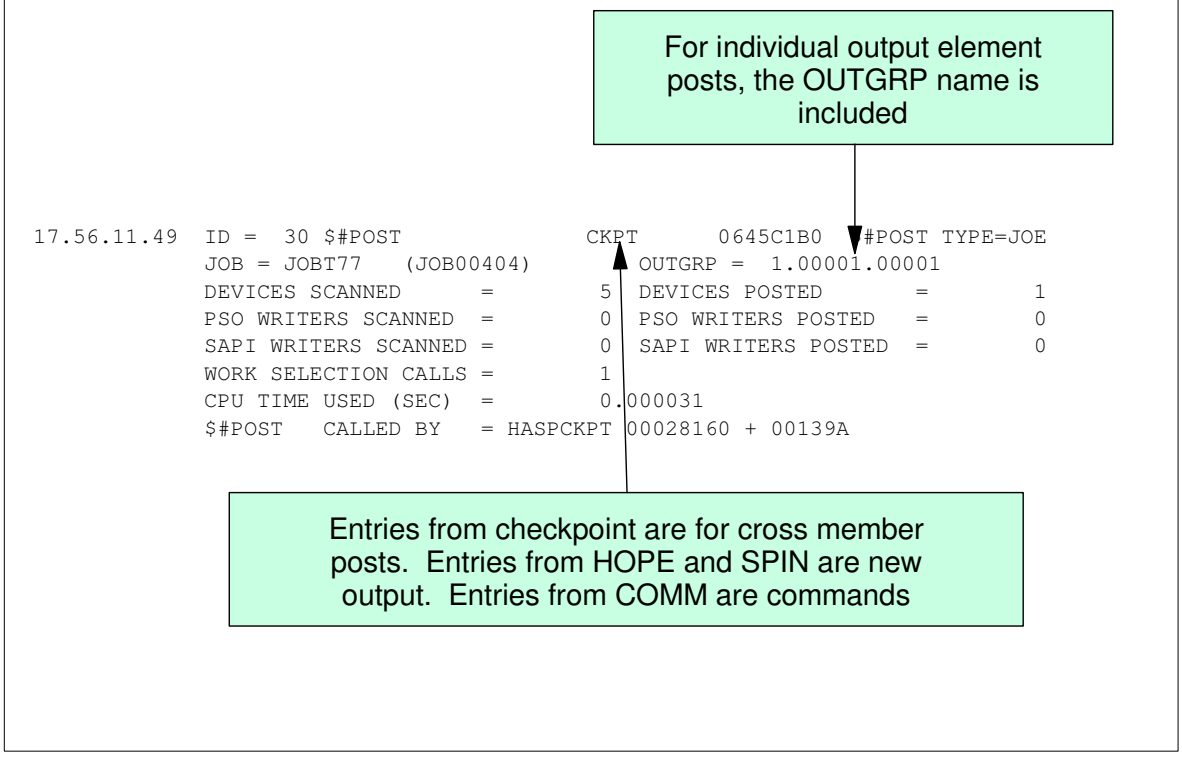
TRACE 30 - $#POST

- Work selection is a 2 part process
  - Devices selecting work to process
  - New and changed output finding devices to wake up
- Overhead on the posting side can be as high as the selection side
- When looking at device setup, look at both trace records to see the effect
- Tuning knobs that this can help with
  - Same as Trace 20
  - Command overhead

Sample TRACE 30



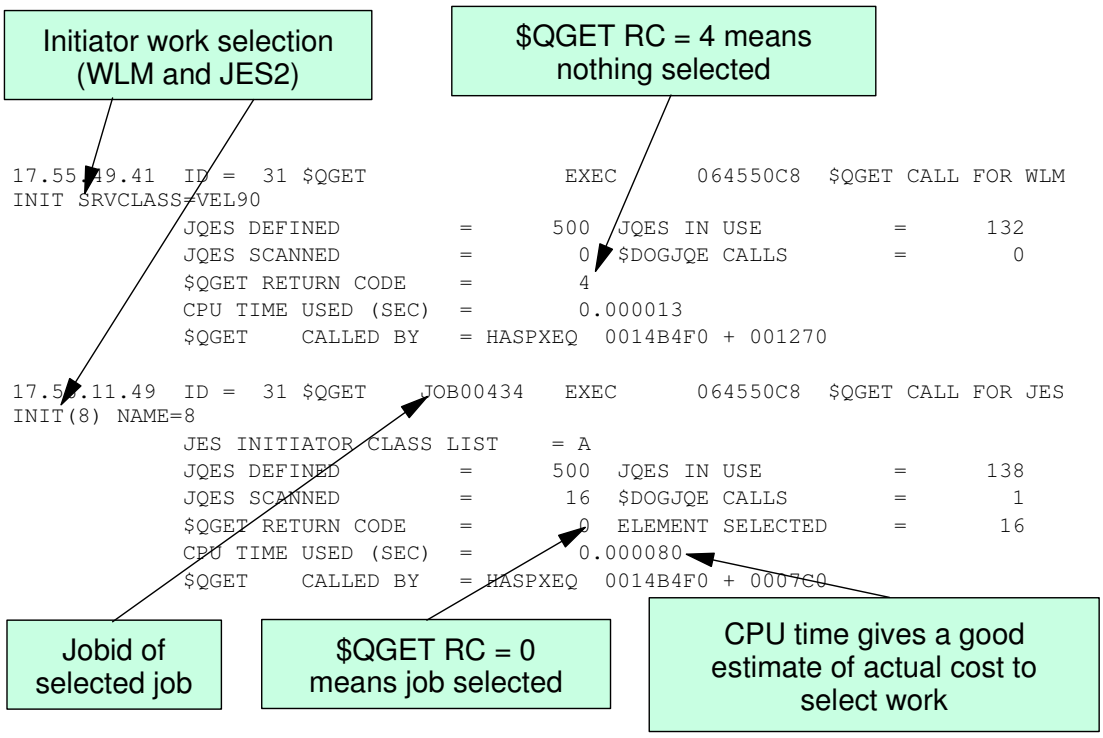
Sample TRACE 30



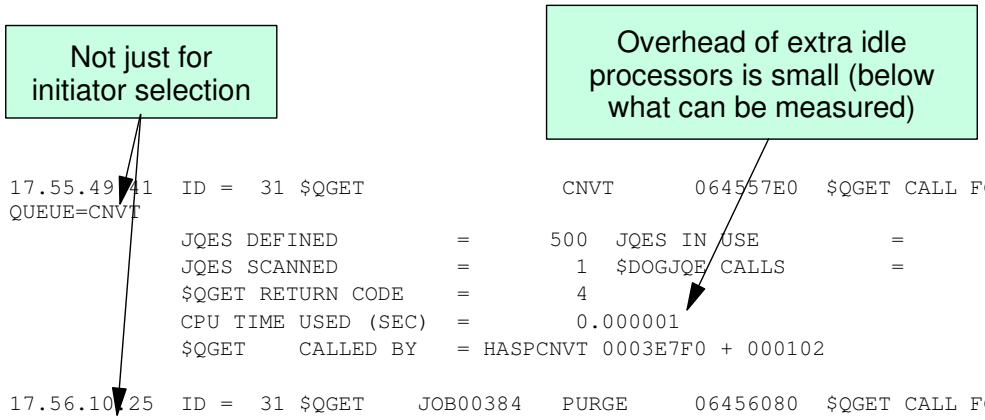
Trace 31 - JOB selection

- Each phase of JES2 processing (other than input) must select work to process
- Offload devices select work to process
- Tuning knobs that this can help with
  - JES2 initiator class list
  - EXIT 14/49 performance impact

Sample TRACE 31



Sample TRACE 31




```
17.55.49.741  ID =  31 $QGET               CNVT      064557E0  $QGET CALL FOR
QUEUE=CNVT
              JQES DEFINED         =      500  JQES IN USE          =      132
              JQES SCANNED         =        1  $DOGJQE CALLS       =        0
              $QGET RETURN CODE    =        4
              CPU TIME USED (SEC)  =        0.000001
              $QGET    CALLED BY   = HASPCNVT 0003E7F0 + 000102

17.56.10.725  ID =  31 $QGET    JOB00384   PURGE     06456080  $QGET CALL FOR
QUEUE=PURGE
              JQES DEFINED         =      500  JQES IN USE          =      145
              JQES SCANNED         =        4  $DOGJQE CALLS       =        1
              $QGET RETURN CODE    =        0  ELEMENT SELECTED    =        4
              CPU TIME USED (SEC)  =        0.000067
              $QGET    CALLED BY   = HASPTRAK 0013FDA8 + 001AE6
```

Sample TRACE 31

```
19.24.19.79  ID =  31 $QGET    JOB00008   EXEC      064550C8  $QGET CALL FOR JES
INIT(1) NAME=1
             JES INITIATOR CLASS LIST    = A
             JQES DEFINED          =      500  JQES IN USE          =       18
             JQES SCANNED          =        1  $DOGJQE CALLS        =        1
             $QGET RETURN CODE     =        0  ELEMENT SELECTED     =        1
             CPU TIME USED (SEC)   =        0.000096
             CPU TIME USED (X14)   =        0.000004
             EXIT 14 RETURN CODE   =        0
             CPU TIME USED (X49)   =        0.000003
             EXIT 49 SKIPPED JQES  =        0
             $QGET    CALLED BY    = HASPXEQ  0014B4F0 + 0007C0
```

Overhead of exits can be measured

Anything else?

- TRACE 27 - PSO/external writer
  - No specific data, but indicates frequency of use, who is making requests, and time to competes (delta in trace time stamps)
  - Can detect run away PSO applications
- TRACE 28 and 29 - SAPI
  - Similar to trace 27 but for the SAPI interface
  - Detects excessive SAPI requests

PERFDATA? CTRACE?

- $D PERFDATA can help tune systems
  - QSUSE info identifies impact of CKPT delays
  - EVENT identifies commands take more than 5 seconds to complete
  - PCESTAT displays all that is known about PCE performance
- CTRACE rolling traces in dumps can help
  - Of limited use. Mostly for performance bugs.
  - Can tell how long PCE was running.

Questions?