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The Runtime Diagnostics (RTD) Project

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The Project

- RTD as reviewed for this project is described in *z/OS V1R13.0 Problem Management Version 1 Release 13 Document Number G325-2564-08 Part 2 Chapter 4*
- Constitutes an extended diagnostic mechanism combining the functions provided by various operator commands, system log message searches, and address space and task status analyses; to produce console and system log messages which can alert supporting personnel, and drive manual and/or automated responses to detected conditions, the latter via e.g. NewEra Event Detectors.

Configuration and Activation

- A detailed multistep procedure is found in Section 2.1 of the *Problem Management* document
- SETROPTS CLASSACT(STARTED) RACLIST(STARTED) should specify
  SETROPTS CLASSACT(STARTED) RACLIST(STARTED) REFRESH

Condition Detection

1. Critical message analysis

- Critical messages from the most recent hour of OPERLOG are displayed as error events
- Events displayed below correspond to messages issued during IPL:

```
F HZR,ANALYZE
HZR0200I RUNTIME DIAGNOSTICS RESULT 300
SUMMARY: SUCCESS
 REQ: 001 TARGET SYSTEM: ESSD6    HOME: ESSD6    2012/05/17 - 15:07:34
 INTERVAL:  60 MINUTES
 EVENTS:
  FOUND: 02 - PRIORITIES: HIGH:02  MED:00  LOW:00
  TYPES: OMVS:01 CF:01
 -------------------------------------------------------------------
EVENT 01: HIGH - CF         - SYSTEM: ESSD6    2012/05/17 - 14:18:16
IXL013I IXLCONN REQUEST FOR STRUCTURE SYSZWLM_WORKUNIT FAILED.
JOBNAME: WLM ASID: 000A CONNECTOR NAME: #ESSD6
IXLCONN RETURN CODE: 0000000C,  REASON CODE: 02010C05
STRUCTURE NOT DEFINED IN THE CFRM ACTIVE POLICY
      CONADIAG0:   00000002
  ERROR: ATTEMPT TO CONNECT TO A COUPLING FACILITY STRUCTURE FAILED.
ACTION: RUN EREP TO DUMP DATA FROM SYS1.LOGREC AND PROVIDE IT TO IBM
 ACTION: SUPPORT.
 -------------------------------------------------------------------
EVENT 02: HIGH - OMVS       - SYSTEM: ESSD6    2012/05/17 - 14:19:41
```

```
BPXP007E STARTING PHYSICAL FILE SYSTEM ZFS IN ADDRESS SPACE ZFS
  ERROR: z/OS UNIX INIT DELAYED BY SLOW PHYSICAL FILE SYSTEM INIT.
 ACTION: GET AN SVC DUMP OF THE INDICATED ADDRESS SPACE, z/OS UNIX AND
 ACTION: ITS ASSOCIATED DATASPACES. PROVIDE THE DUMP TO IBM SUPPORT.
---------------------------------------------------------------------------
```

2. *ENQ contention*

- RTD reports ENQ contention encountered by system address spaces started at IPL e.g. *MASTER*, RASP, OMVS, XCFAS, BPXOINIT, CONSOLE, GRS, JES2.
- Low probability of such contention occurring insofar as other address spaces (IBM or non-IBM) are unlikely to need to ENQ with high frequency and/or long duration (or even at all) on the same resource names as those used by the system address spaces.
- The example in the RTD *ENQ contention* section of the *Problem Management* document is inaccurate in that the ENQ WAITER jobname shown is not that of a system address space; IBM has agreed to a revision.

3. *High CPU*

- RTD address space and task analysis is capable of identifying potentially looping work units:

```
F HZR,ANALYZE
HZR0200I RUNTIME DIAGNOSTICS RESULT 105
SUMMARY: SUCCESS
 REQ: 005 TARGET SYSTEM: ESSD6    HOME: ESSD6    2012/05/10 - 12:42:02
 INTERVAL:  60 MINUTES
 EVENTS:
  FOUND: 01 - PRIORITIES: HIGH:01  MED:00  LOW:00
  TYPES: LOOP:01
  -----------------------------------------------------------------
EVENT 01: HIGH - LOOP       - SYSTEM: ESSD6    2012/05/10 - 12:41:50
ASID:001A    JOBNAME:ESSJGR1L    TCB:008FF3A0
STEPNAME:S1        PROCSTEP:          JOBID:JOB01353 USERID:ESSJGR1
JOBSTART:2012/05/10 - 12:41:05
  ERROR: ADDRESS SPACE MIGHT BE IN A LOOP.
 ACTION: USE YOUR SOFTWARE MONITORS TO INVESTIGATE THE ASID.
  -----------------------------------------------------------------
```

4. *GRS latch contention*

- Latchsets and latches are creatable and obtainable using authorized system services ISGLCRT and ISGLOBT.
- Contention between work units requesting the same latch is detectable by RTD.

- Note that RTD does not report this contention until it has persisted for at least five minutes, the rationale being, per IBM's explanation: "The 5 minute window was instituted in the original design so that either momentary or even moderate contention would not come across as too much noise in the RTD checks". This behavior is not mentioned in the RTD documentation.
- In the following scenario, the jobstep program creates a latchset; obtains an exclusive-access latch; attaches a subtask, passing the latch address, and issues a WAIT
- The subtask then also requests exclusive access to the passed (same) latch:

```
F HZR,ANALYZE
HZR0200I RUNTIME DIAGNOSTICS RESULT 335
SUMMARY: SUCCESS
 REQ: 002 TARGET SYSTEM: ESSD6    HOME: ESSD6    2012/05/10 - 13:17:16
 INTERVAL:  60 MINUTES
 EVENTS:
  FOUND: 01 - PRIORITIES: HIGH:01  MED:00  LOW:00
   TYPES: LATCH:01
 ----------------------------------------------------------------------
EVENT 01: HIGH - LATCH       - SYSTEM: ESSD6    2012/05/10 - 13:17:16
LATCH SET NAME: TEST_LATCHSET
LATCH NUMBER:0        CASID:001A  CJOBNAME:ESSJGR1L
TOP WAITER - ASID:001A - JOBNAME:ESSJGR1L - TCB/WEB:008D8728
TOP BLOCKER- ASID:001A - JOBNAME:ESSJGR1L - TCB/WEB:008FF3A0
  ERROR: ADDRESS SPACES MIGHT BE IN LATCH CONTENTION.
 ACTION: D GRS,AN,LATCH,DEP,CASID=001A,LAT=(TEST*,0),DET
 ACTION: TO ANALYZE THE LATCH DEPENDENCIES. USE YOUR SOFTWARE
 ACTION: MONITORS TO INVESTIGATE BLOCKING JOBS AND ASIDS.
 ----------------------------------------------------------------------
```

- GRS confirmative output:

```
D GRS,AN,LATCH,DEP,CASID=001A,LAT=(TEST*,0),DET
ISG374I 14.39.43 GRS ANALYSIS 836
DEPENDENCY ANALYSIS: CASID=001A
LAT=(TEST*,0)
----- LONG WAITER #1
        JOBNAME: ESSJGR1L  (ASID=001A, TCB=008D8728)
        REQUEST: EXCLUSIVE                   LT:7F5AA07800000000
WAITING  01:28:59 FOR RESOURCE (CREATOR ASID=001A)
TEST_LATCHSET                                LST:7F5ABD00000000E3
0:(ID NOT SPECIFIED)
        JOBNAME: ESSJGR1L  (ASID=001A, TCB=008FF3A0)
        REQUEST: EXCLUSIVE                   LT:7F5AA01000000000
ANALYSIS ENDED: THIS UNIT OF WORK IS NOT WAITING
```

5. *Unix latch contention*

- Contention among system-defined latches unique to the USS/OMVS environment is also detected by RTD.

- Sample output from F HZR,ANALYZE when Unix latch contention is present may be found under z/OS Unix latch contention in *Runtime Diagnostics*
- Insofar as all latches, including Unix, are GRS latches, additional GRS-related information may be found under *z/OS UNIX System Services latch identities*
- IBM could not suggest an artificially contrived scenario to test this feature of RTD.

6. *Local lock suspension*

- It is virtually impossible to encounter this condition in a uniprocessor environment, as once the lock is obtained, z/OS will not permit the obtaining work unit to relinquish control until the lock is released; therefore another work unit cannot gain control to request the lock and thus trigger suspension.
- Testing for this condition must therefore be performed in a multiprocessor environment, where another work unit could gain control on a different processor.