# ^ZSY: System Status for GT.M/YottaDB

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**Abstract**

This paper describes the updates and new functionality in the System Status tools for GT.M/YottaDB.

## 1 Introduction

The ZSY Routine of unknown provenance – was in unreleased VA patch XU*8.0*349 and thus perhaps in the public domain. Its original purpose was to provide an emulation of %SS in Intersystems Cache. It has been almost entirely re-written and much new functionality has been introduced. While developed with VistA/RPMS in mind, it can be used on any GT.M/YottaDB system with a $ZINTERRUPT of "I $$JOBEXAM^ZSY($ZPOS)"

## 2 Invocation

Enter `D ^ZSY` on direct mode. This by default sorts by Process ID. You can use `D QUERY^ZSY` to query by cpu time.

## 3 Output

The output changes based on the size of the screen: $\leq$ 80 columns; 80 columns–130 columns; and >130 columns.

```
GT.M System Status users on 24-APR-18 16:03:06 - (stats reflect accessing
DEFAULT region ONLY except *)
PID   PName   Device       Routine            Name                CPU Time
4257  mumps   /dev/pts/1   INTRPTALL+8^ZSY                        00:00:00
7369  mumps   BG-0         NEWJOB+5^%ZTM      Taskman ROU 1       00:00:00
7373  mumps   BG-0         GO+26^XMKPLQ       WVEHR,PATCH INSTALL 00:00:00
7391  mumps   BG-0         GO+12^XMTDT        WVEHR,PATCH INSTALL 00:00:00
7397  mumps   BG-0         GETTASK+3^%ZTMS1                       00:00:00
7403  mumps   BG-0         GETTASK+3^%ZTMS1   Sub 7403            00:00:00
7409  mumps   BG-0         I6+2^%ZTM                              00:00:00
7411  mumps   BG-0         GETTASK+3^%ZTMS1   Sub 7411            00:00:00
```

Listing 1: 80 column output

```
GT.M System Status users on 24-APR-18 16:35:06 - (stats reflect accessing DEFAULT region ONLY except *)
PID   PName   Device       Routine            Name                CPU Time OP/READ   NTR/NTW        NR0123    #L   %LSUCC  %CFAIL
4257  mumps   /dev/pts/1   INTRPTALL+8^ZSY                        00:00:00 1.14      10/0           0/0/0/0   1    0/0     0/7
7369  mumps   BG-0         IDLE+3^%ZTM        Taskman ROU 1       00:00:00 493.05    10k/0k         1/0/0/0   0    99.95%  0/426
7373  mumps   BG-0         GO+26^XMKPLQ       WVEHR,PATCH INSTALL 00:00:00 90.14     1905/12        0/0/0/0   2    9/14    0/33
7391  mumps   BG-0         GO+12^XMTDT        WVEHR,PATCH INSTALL 00:00:00 59.73     669/12         0/0/0/0   2    9/9     0/23
7397  mumps   BG-0         GETTASK+3^%ZTMS1                       00:00:00 784.04    19k/2k         1/0/0/0   1    99.96%  0/1977
7403  mumps   BG-0         GETTASK+3^%ZTMS1   Sub 7403            00:00:00 0.00      9766/968       3/0/0/0   1    99.35%  0/973
7411  mumps   BG-0         GETTASK+3^%ZTMS1   Sub 7411            00:00:00 0.00      9738/965       3/1/0/0   1    99.53%  0/970
7419  mumps   BG-0         GETTASK+3^%ZTMS1   Sub 7419            00:00:00 0.00      9717/963       7/3/0/0   1    99.02%  0/967
7422  mumps   BG-0         GETTASK+3^%ZTMS1   Sub 7422            00:00:00 0.00      9678/959       13/0/0/0  1    98.25%  0/970
```

Listing 2: 130 column output

```
GT.M System Status users on 24-APR-18 17:05:25 - (stats reflect accessing DEFAULT region ONLY except *)
PID   PName   Device       Routine            Name                CPU Time OP/READ   NTR/NTW      NR0123    #L   %LSUCC  %CFAIL R MB*   W MB* SP MB*
4257  mumps   /dev/pts/1   INTRPTALL+8^ZSY                        00:00:00 1.14      10/0         0/0/0/0   1    0/0     0/7    5.66    12.98 0.10
7369  mumps   BG-0         IDLE+3^%ZTM        Taskman ROU 1       00:00:00 955.95    20k/1k       3/0/0/0   0    99.80%  0/721  2.77    0.68  0.10
7373  mumps   BG-0         GO+26^XMKPLQ       WVEHR,PATCH INSTALL 00:00:00 166.86    3516/12      0/0/0/0   2    9/14    0/33   3.21    0.03  0.10
7391  mumps   BG-0         GO+12^XMTDT        WVEHR,PATCH INSTALL 00:00:00 100.64    1119/12      0/0/0/0   2    9/9     0/23   0.23    0.00  0.10
7397  mumps   BG-0         GETTASK+3^%ZTMS1                       00:00:01 1505.24   37k/4k       2/0/0/0   1    99.96%  81.36% 0.29    2.51  0.10
7403  mumps   BG-0         GETTASK+3^%ZTMS1   Sub 7403            00:00:00 0.00      18k/2k       8/0/0/0   1    99.47%  89.76% 0.00    0.77  0.10
7411  mumps   BG-0         GETTASK+3^%ZTMS1   Sub 7411            00:00:00 0.00      18k/2k       3/1/0/0   1    99.67%  89.79% 0.00    0.73  0.10
7419  mumps   BG-0         GETTASK+3^%ZTMS1   Sub 7419            00:00:00 0.00      18k/2k       19/4/0/0  1    99.09%  89.80% 0.00    0.79  0.10
7422  mumps   BG-0         GETTASK+3^%ZTMS1   Sub 7422            00:00:00 0.00      18k/2k       16/0/0/0  1    98.50%  89.78% 0.00    0.41  0.10
```

Listing 3: >130 column output

Here is by contrast the Cache system status:

```
                    Cache System Status:  4:00 pm 02 May 2018
Process  Device      Namespace      Routine          CPU,Glob  Pr User/Location
     92  /dev/null   PLA            XMKPLQ          8415,815   0  %System
     61  |TCP|9430   PLA            %ZISTCPS        2805,187   0  %System
     66  /dev/null   PLA            %ZTM            9180,1078  0  %System
     68  |TCP|8001   PLA            XOBVTCPL        5355,416   0  %System
     93  /dev/null   PLA            XMTDT           6885,380   0  %System
     94  /dev/null   PLA            %ZTMS1         18615,2779  0  %System

6 user, 0 system, 256 mb global/23 mb routine cache
```

Listing 4: Cache System Status

# 4 Explanation of Columns

## 4.1 PID

This is the Process Number of each process. On GT.M/YottaDB, the process number is the same as job number. This unfortunately is not the same as the Taskman task number.

## 4.2 PName

Process Name. Most of the time it will be "mumps", but it can be "java", "node" or some other process that is opening the database.

## 4.3 Device

Consider this listing:

```
Device
BG-0
BG-0
BG-0
BG-S14823
/dev/pts/22
BG-0
BG-/dev/null
/dev/null
```

Listing 5: Device

This shows the currently active device.

The most obvious thing is the "BG". This means that the job is a background job (not launched by a user, but launched originally by a Job command). However, even background jobs can interact with users: The last BG device in this is listing is actually a CPRS session. The process was created using the Job command.

User "Roll and Scroll" sessions will show as /dev/pty/...

Devices with socket listeners will show as BG-Sport, where port is a numeric port number.

BG-0 devices are usually background jobs without devices in Taskman.

Broker jobs originating from xinetd will show a device of /dev/null unless a device is opened.

## 4.4 Routine

This shows the currently executing line.

## 4.5 Name

This is either the name of the user from File 200 if the process has a DUZ variable defined; or process name if defined in ^XUTL, or nothing otherwise.

## 4.6 CPU Time

Total CPU time (User + System) as reported by ps.

## 4.7 OP/READ

Operations/Read: Number of global operations per database block read obtained via the following formula:

$$\frac{DTA + GET + ORD + ZPR + QRY}{DRD}$$

DRD is the number of database reads; DTA, GET, ORD, ZPR and QRY are the number of operations on globals of $DATA, $GET, $ORDER, reverse $ORDER, and $QUERY (forward and reverse) respectively. This statistic is only for the DEFAULT region of the database.

## 4.8 NTR/NTW

This is the number of non-transaction reads and non-transactions writes into the DEFAULT region of the database. If NTR > 9999, the values will divided by 1024 and displayed in kilos. This statistic is only for the DEFAULT region of the database.

## 4.9 NR0123

This is the number of # of Non-TP transaction Restarts at try 0, 1, 2, and 3. A large number of retries at 2 or 3 is a bad sign. This statistic is only for the DEFAULT region of the database.

## 4.10 #L

Number of locks held by the process.

## 4.11 %LSUCC

Lock success percentage calculated by:

$$\frac{LKS}{LKS + LKF}$$

LKS is the number of successful locks; and LKF is the number of unsuccessful locks. If LKS + LKF is < 100, then it will be shown as a fraction; otherwise it will be shown as a percentage with 2 decimal points. This statistic is only for the DEFAULT region of the database.

### 4.12 %CFAIL

Critical section acquisition failure percentage calculated by:

$$\frac{CFT}{CFT + CAT}$$

CFT is the total of blocked critical section acquisitions; CAT is the total of critical section acquisitions successes. Like locks, if CFT + CAT $<$ 100, then it will be shown as a fraction; otherwise, it will be shown as a percentage with 2 decimal points. This statistic is only for the DEFAULT region of the database.

This number is hard to use in isolation. It is only useful as a trend point. My system shows >80% failure rate for taskman processes in a tight loop.

### 4.13 R MB

Data read from disk in megabytes, as reported by the OS.

### 4.14 W MB

Data written to disk in megabytes, as reported by the OS.

### 4.15 SP MB

This is how large the string pool is. This is a good proxy for how much heap memory is being used by GT.M/YDB for the symbol table. This is obtained using $view("spsize").

# 5 Job Examination Utility

A job examination utility is provided in order to assist with troubleshooting specific jobs. It can be invoked in two ways: either run D ZJOBˆZSY, and then select a job number from the list; or run D ZJOBˆZSY(job_number) to interrogate a specific job number. You can also use one of these alternate entry points:

- D EXAMJOBˆZSY[(job_number)]
- D VIEWJOBˆZSY[(job_number)]
- D JOBVIEWˆZSY[(job_number)]

Pressing enter on the screens that are displayed updates them. If you want to exit, type ˆ.
Following is the screen obtained from D ZJOBˆZSY:

```
GT.M System Status users on 02-MAY-18 15:16:38
PID   PName   Device       Routine            Name                CPU Time
11422 mumps   BG-0         IDLE+3^%ZTM        Taskman ICARUS 1    00:00:03
11481 mumps   BG-0         GO+26^XMKPLQ       POSTMASTER          00:00:00
11483 mumps   BG-0         GO+12^XMTDT        POSTMASTER          00:00:00
11489 mumps   BG-S14823    LGTM+25^%ZISTCPS   POSTMASTER          00:00:01
13063 mumps   /dev/pts/21  INTRPTALL+8^ZSY    USER,ONE            00:03:01
15287 mumps   BG-0         GETTASK+3^%ZTMS1                       00:00:00

Total 6 users.

Enter a job number to examine (^ to quit):
```

Listing 6: D ZJOBˆZSY

Selecting a job number, or invoking it directly using D ZJOBˆZSY(PID) will let you to the follow screen:

```
JOB INFORMATION FOR 11483 (2018-MAY-02 15:26:57)
AT: GO+12^XMTDT:  . . H XMHANG

Stack:
1. SUBMGR+3^%ZTMS1                          D PROCESS^%ZTMS2 G:$D(ZTQUIT) QUIT^%ZTMS
2. PROCESS+9^%ZTMS2                         D TASK^%ZTMS3 I ZTYPE="C"!$D(ZTNONEXT) Q
3. 4+10^%ZTMS3                              D RUN
4. RUN+4^%ZTMS3                             D @ZTRTN
5. GO+5^XMTDT                               F  Q:$P($G(^XMB(1,1,0)),U,16)  D
6. GO+11^XMTDT                              . F  D  Q:$$TSTAMP^XMXUTIL1-XMWAIT>60
7. GO+12^XMTDT:                             . . H XMHANG

Locks:
LOCK ^XMBPOST("POST_Tickler") LEVEL=1
LOCK ^%ZTSCH("TASK",3479) LEVEL=1

Devices:
0 OPEN RMS STREAM NOWRAP
0-out OPEN RMS STREAM NOWRAP

Breakpoints:

Global Stats for default region:
BTD: 0          CAT: 26         CFE: 0          CFS: 16k        CFT: 129        CQS: 0
CQT: 0          CTN: 188m       CYS: 1          CYT: 1          DEX: 0          DFL: 0
DFS: 0          DRD: 13         DTA: 30         DWT: 14         GET: 2262       JBB: 1568
JEX: 0          JFB: 0          JFL: 0          JFS: 0          JFW: 0          JRE: 0
JRI: 0          JRL: 12         JRO: 1          JRP: 0          KIL: 4          LKF: 2
LKS: 9          NBR: 10k        NBW: 11         NRO: 0          NR1: 0          NR2: 0
NR3: 0          NTR: 3985       NTW: 12         ORD: 1677       QRY: 0          REG: DEFAULT
SET: 10         TBR: 0          TBW: 0          TCO: 0          TC1: 0          TC2: 0
TC3: 0          TC4: 0          TRO: 0          TR1: 0          TR2: 0          TR3: 0
TR4: 0          TRB: 0          TTR: 0          TTW: 0          ZPR: 4          ZTR: 0


String Pool (size,currently used,freed): 102056,5684,0

Enter to Refersh, V for variables, I for ISVs, K to kill
L to load variables into your ST and quit, ^ to go back:
D to debug (broken), Z to zshow all data for debugging.
```

Listing 7: Job Examination Screen

Pressing enter on this page refreshes the information. Pressing enter frequently will give you a good view of what's happening in an execution.

The sections should be self-explanatory.

Pressing V or I will show you variables and Intrinsic Special Variables(ISV). They are just printed in a vertical list so that they are easy to copy and paste.

```
%=1
%ZPOS="GO+12^XMTDT"
%ZTIME=5596168159
%ZTPFLG("BalLimit")=100
%ZTPFLG("HOME")="ICARUS:foia.2018.02"
%ZTPFLG("LOCKTM")=3
%ZTPFLG("MIN")=1
%ZTPFLG("RT")=0
%ZTPFLG("USER")=18
%ZTPFLG("XUSCNT")=59
%ZTPFLG("ZTPN")=1
%ZTPFLG("ZTREQ")=1
%reference="^XMB(3.9,""AF"",0)"
DILOCKTM=3
DT=3180502
DTIME=1
DUZ=.5
DUZ(0)="@" (etc...)
```

Listing 8: Variable List

```
ISVs:
$DEVICE=""
$ECODE=""
$ESTACK=9
$ETRAP="D ERROR^%ZTMS HALT"
$HOROLOG="64770,56506"
$IO=0
$JOB=11483
$KEY=""
$PRINCIPAL=0
$QUIT=1
$REFERENCE="^XUTL(""XUSYS"",11483,""JE"",""I"",10)"
$STACK=9
$STORAGE=2147483647
$SYSTEM="47,foia.2018.02"
$TEST=1
$TLEVEL=0 (etc...)
```

Listing 9: ISV List

K will kill the process (actually, it sends it to HALT^ZU after cleaning it up–killing it softly by forcing it to drink a cup). ^ will take you back; D (debug) is currently broken; and Z is there for the developer's use.

# 6 Other Entry Points

^ZSY includes various other entry points that can be used by developers and system managers. Here they are.

## 6.1 D TMMGR^ZSY [Public]

List Taskman Manager processes only. Output:

```
GT.M System Status users on 02-MAY-18 16:01:02
PID   PName   Device       Routine            Name                CPU Time
11422 mumps   BG-0         IDLE+3^%ZTM        Taskman ICARUS 1    00:00:04
```

Listing 10: TMMGR Entry Point

## 6.2 D TMSUB^ZSY [Public]

List Taskman Submanger processes, including those currently "otherwise" engaged.

```
GT.M System Status users on 02-MAY-18 16:03:46
PID   PName   Device       Routine            Name                CPU Time
11481 mumps   BG-0         GO+26^XMKPLQ       POSTMASTER          00:00:00
11483 mumps   BG-0         GO+12^XMTDT        POSTMASTER          00:00:00
11489 mumps   BG-S14823    LGTM+25^%ZISTCPS   POSTMASTER          00:00:01
15287 mumps   BG-0         GETTASK+3^%ZTMS1                       00:00:02
```

Listing 11: TMSUB Entry Point

## 6.3 $$UNIXLSOF^ZSY(.procs) [Kernel Use Only]

This gives you a listing of all the processes accessing the DEFAULT region of the database. The extrinsic output is the number of processes; while `.procs` contains an M array of the process numbers.

This API should be used by Kernel level applications only.

```
>W $$UNIXLSOF^ZSY(.zzz)
6
>zwrite zzz
zzz(1)=11422
zzz(2)=11481
zzz(3)=11483
zzz(4)=11489
zzz(5)=13063
zzz(6)=15287
```

Listing 12: UNIXLSOF Entry Point

## 6.4 D INTRPT^ZSY(PID) [Kernel Use Only]

Send a GT.M Interrupt to a process specified by its PID.

## 6.5 D INTRPTALL^ZSY[(.procs)] [Kernel Use Only]

Use the $$UNIXLSOF^ZSY(.procs) API to find all processes accessing the DEFAULT region and interrupt all of them. You can optionally pass in .procs to get a list of all the PIDs that got interrupted.

## 6.6 D HALTALL^ZSY [Kernel Use Only]

"Softly" (^XUSCLEAN, HALT^ZU) kill all processes.

## 6.7 D HALTONE^ZSY(PID) [Kernel Use Only]

"Softly" kill a single process specified by PID