



Database Health Check Automation

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Introduction

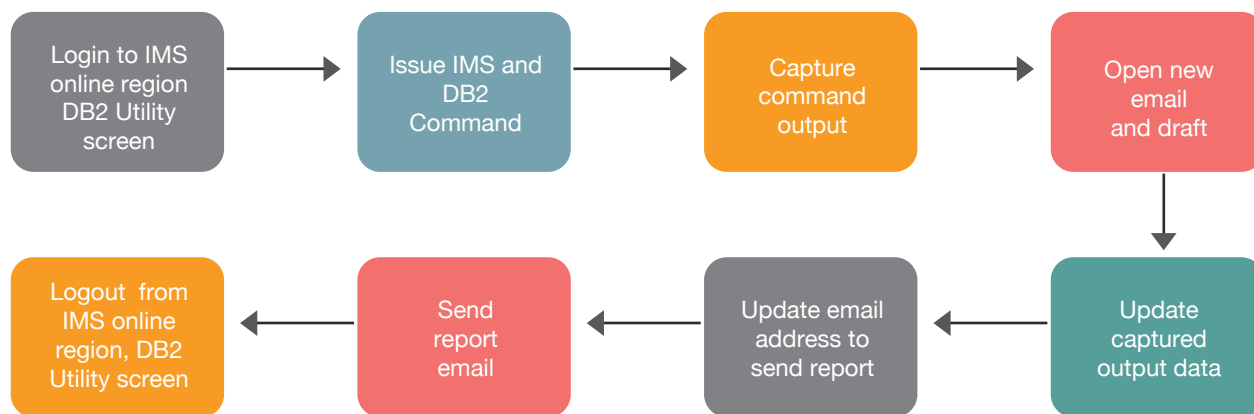
The paper highlights automation of Database Health Check, which is achieved through REXX program. The objective of this automation is to reduce manual effort and prevent outage.

Every morning the health check is done for IMS databases, transactions, subsystems connectivity and DBRC flags. For DB2 database and tablespace objects are validated, along with Utility status, to make sure tablespaces are not held by any other object/utility, restricting the regular business operations.

Proposal for Automation

In case of any errors, the DBA comes to know only after the databases go into inaccessible state, which is a kind of outage. In order to fix the issue, he has to issue commands manually to know the status of databases, transactions, subsystems and DBRC error information.

To investigate the status of IMS environment and its availability, we perform the following steps manually -



1. Log into IMS online region and DB2 utility screen.
2. Issue DISPLAY commands for IMS in IMS region and for DB2 in DB2 utility screen.
3. Capture the command output.
4. Open new email and draft note to send the output of commands as status report.
5. To check the DBRC flags, execute REXX program through ISPF and get the status.
6. Verify DBA team members/Group email id added to the delivery list.
7. If everything looks fine, send the report to DBA team.

These above mentioned Database Health Check steps need to be performed from Monday to Friday, throughout the year. To complete this activity it takes 20 minutes every day. To save effort and time, the process has been automated.

Proposed Solution

As a proactive measure to check the status of the transactions, databases, subsystems and DBRC errors, batch jobs are used that utilize SPOC and IKJEFT01 utilities to issue the commands. The output of these utilities will be used as input to REXX program, which validates the system (the way DBA does it manually) and creates the status report. If any anomalies are found during the validation, an error status report will be sent to the DBA team, who then intervenes to fix the error. This solution is quite simple to implement in all the IMS environment.

Steps for Automation

The job uses REXX program to issue IMS commands with SDSF console authority, and captures the output in a file. The captured output is then validated to know the status of databases. The RECON information is analyzed for all the databases and validated for DBRC flags errors. Based on the successful validation of Database status or Recon information, normal/error status report email is sent through SMTP. This process is executed through JCL, and can be scheduled for production and test environments.

Below are the steps to automate -

1. Identify the tool to issue commands through Batch process in IMS environment.
There are two tools available for this purpose:
 - a. SPOC Utility: Use the Batch SPOC (Single Point of Control) utility to submit IMS™ operator commands to members of the IMSplex. In this utility, the program parameters define the IMSplex environment and the input is IMS operator commands. Output from the utility is command responses written to the SYSPRINT file.
 - b. SDSF Utility: Use the Batch SDSF (System Display and Search Facility) utility to issue often-repeated SDSF commands, by creating list of the commands as control statements. Execute commands through REXX program and write the results into a file.

Based on the environment set up in other projects, either of the tools can be used for automation. In our project, we used SPOC tool to accomplish the task.
2. Identify the tool to issue commands through Batch process in DB2 environment.
The multipurpose IBM Utility 'IKJEFT01' is used to issue DB2 command. Output from the utility is command responses written to the SYSPRINT file.
3. Identify the programming language that helps attain the need.
In mainframe environment, REXX is a simple and useful language for administrators.
4. Provide the input to the program to issue commands and validate.
 - a. First input will be the IMS and DB2 commands.
 - b. To understand the IMS / DB2 region for which the commands have to be performed, we provide 4 characters IMS / DB2 region ID as the second input. The commands output will be written into a file.
 - c. To perform IMS / DB2 database health check validation through REXX program, the commands output file will be used as input.
5. Generate reports.
Based on the validation, a normal/error report will be generated in the file.
6. Identify the type of mail protocol to be used.
SMTP is used to send the status report through batch job.
7. Create individual jobs to get the status for subsequent IMS/DB2 environments. This helps to investigate the subsequent environments and produce health check reports faster.

Requirements Table

Requirements	Resources
Tools	SPOC or SDSF , IKJEFT01
Programming Language	REXX
Input commands to be issued to the respective region	IMS/DB2 Environment IDs and IMS/DB2 commands
Input for validation through REXX program	IMS/DB2 Environment IDs and IMS/DB2 commands output file
Reports to generate	Normal/Error report
Delivery Email address	DBA team
Mail protocol	SMTP

Table - 1

Perform IMS Commands

Below is the list of commands used to perform the health status report.

The command used to display the status for all kind of databases:

`/DISPLAY DB ALLOCF, EEQE, BACKOUT, LOCK, NOTINIT, RECALL, STOPPED, INQONLY.`

The STATUS command with TRANS keyword will display the conditions that need DBA intervention.

`/DISPLAY STATUS TRANS.`

The SUBSYS keyword displays the status of the connection between IMS and the status of external subsystem.

`/DISPLAY SUBSYS ALL.`

Perform DB2 Commands

Below is the list of commands used to perform the health status report.

The command used to display the status for tablespace status that require DBA intervention.

CHKP, COPY, DBETE, RECP, RBDP, PSRBD, AREO, AREOR, REORP, RO, STOP, STOPE, STOPP, LSTOP and RESTP.

`-DIS DB(*) SPACENAM(*) RESTRICT`

The command used to validate tablespaces that are not held by any other utility function restricting regular business operations.

`-DIS UTIL(*)`

Health Check Status Validation

The output of SPOC and IKJEFT01 utility will be available in the generated files. This will be passed as input to the REXX program for validation. Below is the list of validations that will be done in the REXX program.

- Database status validation
`ALLOCF, EEQE, BACKOUT, LOCK, NOTINIT, RECALL, STOPPED and INQONLY`
- Transaction status validation
`LOCK, PSTOPPED, PUR, QERROR, SPND, STOPPED and USTOPPED`
- Subsystem connectivity status validation
Mainly focused on Connectivity
- DBRC flags status validation
`BACKOUT NEEDED, RECOVERY NEEDED, READ ONLY, IC NEEDED CNT, PROHIBIT AUTH, RECOVERABLE, EEQE COUNT, PARTITION INIT NEEDED, PARTITION DISABLED and SSID NOT`
- Tablespace status validation
`CHKP, COPY, DBETE, RECP, RBDP, PSRBD, AREO, AREOR, REORP, RO, STOP, STOPE, STOPP, LSTOP and RESTP`
- Utility status validation
Mainly focused on the tablespaces that are not held by any other utilities.

Error messages from the above validations are considered as anomalies and they require immediate DBA intervention to fix the outage.

Various Health Check Report

The health check report will be produced as per the status of IMS/DB2 databases, object's availability and its connectivity. Based on validation, the result will be written in file as normal or error report. For each system, these files will be allocated to jobs and used by rexx program to write the output reports. These files will exist until the next run of the job.

Normal Report: Here is a sample normal report for your reference.

```
MORNING STATUS REPORT FOR IMSX 14 NOV 2016 06:00:04
```

```
-----  
DATABASE TYPE      ACCESS  CONDITIONS  
*16319/060003*
```

```
**TRAN***PSBNAME  
STATUS UNRESTRICTED  
*16319/060003*
```

SUBSYS	CRC	REGID	PROGRAM	LTERM	STATUS
QXXX					CONN
		15	XXXXXXX	3307	CONN
		17			CONN
		2	XXXXXXX	PSBNAME	CONN
PXXX	#				CONN
		14	XXXXXXX	3307	CONN
		16			CONN
		2	XXXXXXX	PSBNAME	CONN
		7			CONN
DB2X					CONN
		14	XXXXXXX	3307	CONN
		16			CONN
		2	XXXXXXX	PSBNAME	CONN
		7			CONN

```
*16319/060003*
```

```
IMSX DATABASE RECON STATUS
```

```
-----  
IMSX : No DB Recon errors
```

```
MORNING STATUS REPORT FOR DB2X 14 NOV 2016 06:00:04
```

```
-----  
*****  
*   DISPLAY DATABASE SUMMARY RESTRICTED  
*****
```

NAME	TYPE	PART	STATUS	PHYERRLO	PHYERRHI	CATALOG	PIECE
*****	NO SPACES	FOUND					
*****	DISPLAY OF DATABASE	XXXXXXXX	ENDED	*****			

```
*****  
*   DISPLAY UTILITY SUMMARY  
*****
```

```
- NO AUTHORIZED UTILITY FOUND FOR UTILID = *  
'-DIS UTIL' NORMAL COMPLETION
```

Note: The IMS/DB2 Environment, Database, Transaction, PSB and Subsystem names are changed for security.

This report shows error-free databases, transactions, subsystem connectivity and recon for IMS and for DB2, unrestricted or not held by other utilities. From this, we get to know the IMS and DB2 environment is running fine.

Error Report: Here is a sample error report for your reference.

```

MORNING STATUS REPORT FOR IMSX 14 NOV 2016 06:00:04
-----
DATABASE  TYPE      ACCESS  CONDITIONS
DBDXXXXX  DL/I      UP      STOPPED, NOTOPEN
DBDXXXXX  DL/I      RO      STOPPED, NOTOPEN
DBDXXXXX  DL/I      RO      INQONLY
DBDXXXXX  DL/I      EX      NOTOPEN
DBDXXXXX  DL/I      EX      ALLOCS
*16319/060003*

**TRAN***PSBNAME
ABCDEP    XXXXXXXX  STOPPED
*16319/060003*

SUBSYS    CRC REGID PROGRAM  LTERM    STATUS
QXXX
          2
PXXX      #
          2
DB2X      |
          14
          2
          2
*16319/060003*

IMSX DATABASE RECON STATUS
-----
DBD=DBDXXXXX; IMMEDIATE DBA INVESTIGATION NEEDED FOR THESE CONDITIONS
IC NEEDED CNT=1

MORNING STATUS REPORT FOR DB2X 14 NOV 2016 06:00:04
-----

*****
*   DISPLAY DATABASE SUMMARY RESTRICTED
*****

NAME      TYPE PART   STATUS      PHYERRLO PHYERRHI CATALOG  PIECE
-----
ONPXXXXX  TS          RW,AREO
ONPXXXXX  TS          RO,CHKP
ONPXXXXX  TS          RW,COPY
ONSXXXXX  IX          RW,COPY

***** DISPLAY OF DATABASE XXXXXXXX ENDED *****

*****
*   DISPLAY UTILITY SUMMARY
*****

- NO AUTHORIZED UTILITY FOUND FOR UTILID = *
'-DIS UTIL' NORMAL COMPLETION

```

Note: The IMS environment, database, transaction and subsystem names are changed for security reasons.

For the given IMS region

- Some of the databases are in STOPPED, INQINLY, NOTOPEN and ALLOCS status
- Some of the transactions are in STOPPED status
- There is no any external connectivity issue
- Recon information alerts that IMMEDIATE DBA INVESTIGATION NEEDED FOR THESE CONDITIONS IC NEEDED CNT=1

In the error report example, for the mentioned database, the recon flag has been set as Image Copy is needed for the database by some other utility or job. In this scenario, the database is online with 'not accessible mode'. Since no user attempted to access the database, no incident was reported, otherwise this would have been reported as an outage.

For the given DB2 region

- Some of the tablespaces are in AREO, CHKP, COPY pending status
- There is no utility interacting with any of the tablespaces

In the error report example, for the mentioned tablespaces, pending or restrictive status has been set as ADVISORY REORG, CHECK PENDING and IMAGE COPY is needed by some other utility, DBA activity or job. In this scenario, the tablespace is online with 'not accessible mode'. Since no user attempted to access the tablespaces, no incident was reported, otherwise this would have been reported as an outage. This report helps DBA to prevent an outage and fix the issue before someone gets affected.

Walkthrough of Job Steps

The job used to generate the report will have 6 steps -

1. Scratch the command output dataset for IMS and DB2.
2. IMS commands are given as input to SPOC utility for specified region. Output will be generated and pushed into a dataset.
3. DB2 commands are given as input to IKJEFT01 utility for specified region. Output will be generated and pushed into a dataset.
4. Both IMS and DB2 command output is pushed back to the job sysprint using IEBGENER utility. This step is optional for other projects.
5. Scratch previous day's report file since the same must be used for today's report.
6. Validate for anomalies using the IMS and DB2 region IDs along with output files from step2 and step 3. This step will produce error report and normal report.
7. If normal report is generated in step 6, send a successful email status report.
8. If error report generated in step 6, send an error email status report.

Publish Report

- SMTP was used to send status report through email
- To send status report the job has 2 steps in it
- The job has been written to send the report based on the return code of job step
- The email contacts can be maintained in control card member and placed at control card library. Make sure you have access to make changes.
- For each environment, there should be two control cards for normal and error report
- These control cards are maintained by DBA team

Benefits

- Keeps the environment stable and available 24/7
- Helps DBA to resolve the issue before anyone gets affected and prevents outage
- Analyzes the health of systems and minimizes the manual effort of DBA
- Ensures timely availability of DB availability reports to DBA team
- Saves manual effort to approximately 0.03 FTE/month

Below is the comparison between time required for manual and batch automation process.

Steps Performed	Manual Efforts (Time taken in seconds)	Through Batch (Time taken in seconds)
Login to IMS online region	20 seconds	Time taken is calculated based on job run. Job runs within 00.00.10 seconds.
Issue IMS commands	120 seconds	
Capture command output	80 seconds	
Login to DB2 utility screen	20 seconds	
Issue DB2 commands	90 seconds	
Capture command output	80 seconds	
Open new email	10 seconds	
Update output data	30 seconds	
Update email address	30 seconds	
Send report	10 seconds	
Logout from IMS online region	10 seconds	
Logout from DB2 utility screen	10 seconds	
Total time consumed per IMS and DB2 region (in seconds)	510 seconds i.e. 8 minutes and 5 seconds	00.00.10 seconds

Table - 2

Total time saved per IMS and DB2 region is $510 - 10 = 500$ seconds.

Usage of this Automation

The health check report automation can be used in all Mainframe projects handling IMS databases. It reduces manual efforts and prevents outage.

References

- 'IMS Command Reference Version 9' – IBM Manual
- 'IMS System Utilities Reference Version 10' – IBM Manual
- 'Implementing REXX Support in SDSF' - IBM Redbook

Author



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Jayamurugan has 14 years of experience in the IT industry, with expertise in administering IBM Mainframe Databases - IMS and DB2. As part of various assignments undertaken, he was involved in application development, design analysis, application maintenance and database administration in Mainframe projects.

Jayamurugan has experience in Management/Process Methodologies like Database Management, Resource Management, Systems Management, Planning and Execution, ITIL methodology, SDLC methodology, Client Relationship Management. He is part of Mphasis Data Engineering Practice – Senior Database Administrator and Subject Matter Expert for IMS Database. Jayamurugan holds a Master Degree in Information Technology and Management (MSc IT & M) from University of Periyar.

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