Workflow for managing database space

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This workflow is intended to be used when you have customer that complain about space related issues.

Space related issue

1.Scope the problem

Before any of the points below, generate an **ASC** report.

What is the customer complaining about?

Is he complaining about shrink database? For example, it doesnt finish. If yes, jump to 2

The customer is getting an error like "the Transaction Log for database 'Database' is full due to XX", or it is large. If yes, go to 3

The error is "Could not allocate a new page for database ... because of insufficient disk space in filegroup PRIMARY", increasing rapidly or almost full. Step into 4

The data is deleted, but there is no reflection on the space used. If this is the case, jump to 5

Go to 6 if the issue is related with tempdb consumption.

If the customer is complaining about used storage on Managed Instance and you are not sure where to start, check the TSG Troubleshooting of space used on managed instance. After having an idea of where the space is

being used, come back to this workflow.

2.Shrink database

When shrinking a datafile what SQL does is, move pages from the end of the datafile so it can free space from the end. After moving the pages, it will shrink the datafile. For example, if the customer is shrinking 20 GB in one single batch, the shrink of the file will only happen when 20 GB is released at the end on the datafile.

Some points to look at:

- make sure that the shrink operation is not being blocked (pages can only be moved when is not being used). Check blocking TSG
- use incremental shrinks. Shrink can also improved if indexes are rebuilt before the shrink.
- if the database contains Columnstore indexes, index rebuild is especially important. If this the case, there is a error message associated with it. Check this TSG
- Shrink can fail for a variety of reason. Use this query to get the error message associated. If the shrink failed with the error 3140, it could mean that the shrink failed because there was a backup running. Check the TSG Shrink fails with error 3140 Could not adjust the space allocation for file to help you on the telemetry analysis and some useful queries to run on customer side.

3.Transaction log full or near full

The first point to check here is on what the transaction log is waiting on. This piece of data can be obtained on customer side by running the query below on customer side:

```
select name, log_reuse_wait_desc from sys.databases
```

On XTS this data is available on the **Database Replicas** view, **Database info** section.

There could be also the case that the transaction log file has a large percentage of space allocated but not used (transaction log file almost empty) - check How to shrink a transaction log

If there is an error of transaction log full, the error message will state what is the log reuse wait.

If LOG_BACKUP 3.1

If ACTIVE_TRANSACTION 3.2

If REPLICATION 3.3

If OLDEST_PAGE 3.4

If AVAILABILITY_REPLICA 3.5

3.1 LOG_BACKUP

Check this TSG

3.2 ACTIVE_TRANSACTION

This means that the log is being hold up by transaction(s). Check this TSG.

The solution could be to kill the transaction. Before doing this, understand the origin and reason of the transaction. Might be useful to avoid reoccurrences.

`sp_who2 <session_id>` will give you details on the login and client. `dbcc inputbuffer (<session_id>)` will give you the code that is being executed

3.3 REPLICATION

Can be related to Change Data Capture or Transactional replication. Check the transactional replication TSG here and here. Or for Change Data Capture

3.4 OLDEST_PAGE

Jump to this TSG

3.5 AVAILABILITY_REPLICA

This means that transaction log records are being applied on the geo secondary. Check for the secondary availability or slow performance on the secondary (an ASC report on the secondary will reveal you that). Also this can mean a long transaction on the primary. On ASC, check **Performance**->**Blocking & Deadlocking**->**Long Running Transactions Summary**

4. Datafile space full or near full

Go to ASC **Performance**->**Space issues** and find the biggest databases on **Database on Disk and Max Size** (if the customer didnt already mentioned the database).

After this, use the query:

```
MonDmIoVirtualFileStats | where LogicalServerName =~ "azuresqlmi2" | where db_name =~ "ac0bce2d-0ab1-4316-aa3e-ceb18a8f973f" | where type_desc == "ROWS" //looking only for | where is_primary_replica == 1 | project TIMESTAMP, file_id, type_desc,spaceused_mb, max_size_mb, size_on_disk_mb =(size_on_disk_bytes/1024/1024), file_id
```

If you see a huge gap between used and allocated space, go to 41

If see an exponential growth? If yes, go to 42

4.1 Misconception around allocated and space

Note that this is expected. When data is deleted, the allocated space will not decrease (unless the database has autoshrink. Note that in any way you should suggest autoshrink. This has huge implications on performance - the shrink operation that locks pages, IO and CPU generated by the operations and the fragmentation introduced on indexes).

Just follow this the TSG on incremental shrinks

4.2 PVS, Ghost records and table growth

Check for PVS size and Ghost records.

Also check this TSG on table size evolution. Sometimes used space growth is related on the amount of data that is being inserted.

You might want also to check on point 5. Sometimes the problem is not related with actual data, but unallocated space.

5. Data is being deleted but used space is not changing

This very frequent on databases that relies on HEAP tables, especially on tables that after being loaded the command used for purging is delete. Take a look at HEAP TABLES

6. Tempdb

If the issue is related with tempdb, check the following TSG's

Troubleshoot tempdb from the telemetry

[Resolve tempdb related errors and exceptions]
[https://supportability.visualstudio.com/AzureSQLDB/_wiki/wikis/AzureSQLDB.wiki/677212/Temp-DB-Resolve-tempdb-related-errors-and-exceptions]

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