Impact of Available RAM on the Performance of Microsoft SQL Server MS SQL While Refreshing ETL Formulas

Symptoms
The ETL refresh is taking much more time to finish than it did previously. This change might occur over a period of just days or weeks. Looking in more detail it’s seen that considerable processing time is attributed to formula refresh. For example, a refresh which recently took 2 hours to complete, now takes 3, 4, or even 5 hours.

Typical Causes
Without sufficient RAM to cache and process entire tables in RAM, especially during the formula refresh stage of the ETL refresh process, SQL Server is forced to do lots of relatively slow disk IO. Compared to accessing the data from a memory cache, direct access to the physical disk (Disk IO) takes a lot more time.

NOTE: Before spending too much time debugging an unusual performance issue reboot the server and test the system again. Quite often a reboot will bring the system back to its normal operation.

Recommended Solutions

Recommendation # 1 Based on Largest Table with Formulas
We recommend that SQL Server be able to allocate at least 2 times the size of the largest data warehouse table containing formulas to allow for growing table sizes. For the database shown in Figure 1 the recommended RAM is 24GB.

Recommendation # 2: RAM for Best Performance Based on Total Database Size
For best performance, all data warehouse’s tables should fit in RAM. To see how much that is, check how big the SQL database’s data file size is, and then provide SQL with more RAM than that. See example below, SQL should have 64GB of RAM available for top performance.

Concepts
To process formulas efficiently, SQL must be able to allocate enough RAM to cache the largest table that contains formula fields refreshed by the ETL. RAM for caching tables that have no formulas to refresh make little difference in this regard.

Examples
Figure 1 below shows that the largest table of this database uses a “data space” of about 12GB. SQL Server will require more than 12BG of RAM to run the formulas from that table in order to refresh efficiently.
ETL Refresh Performance: Memory, SQL Server & Data Warehouse Table Size

To run a report showing the data in Figure 1
1. Open Microsoft SQL Server Management Studio
2. Right-click on the name of the data warehouse database
3. Click Reports, Standard Reports, Disk Usage by Top Tables.

The figures below show Memory (private working set) information from two different computer platforms. The Windows platform shown in Figure 2 would refresh the formulas of a 12GB table much more slowly than the server shown in Figure 3.

Figure 1 Table E1137 uses over 12GB (12,116,688 KB) of disc drive space.

Figure 2 On this computer platform the Memory (private working set) column of Window’s Task Manager shows that about 11.3GB of RAM is allocated to SQL Server.
Figure 3 In contrast to the figure above the Memory (private working set) column of Window’s Task Manager shows that almost 17GB of RAM is used by the sqlserver.exe process. With this amount of memory for SQL Server we would expect better formula refresh performance for a 12GB table.

**Maximum Server Memory Setting**

MS SQL Server will try to allocate as much RAM for itself as it needs for efficient operation up to the level set by Maximum server memory limit. We recommend keeping this value set at the highest value allowed by SQL Server.

**SQL Server Memory Settings**

1. Open SQL Management Studio
2. Right-click the Server Name (it’s the top line in the Object Explorer panel.)
3. Click Properties.
4. Click Memory on the Select a page panel.
Figure 4 shows a SQL Server instance with the default “Maximum server memory” value set during installation. This value might have been changed by a Window’s system manager in an attempt to manage the demands for RAM by other apps running on this server. However, there can be significant performance problems when SQL Server does not have enough RAM to run the data warehouse refresh efficiently as described in this document.

![SQL Server memory options](image)

**Figure 4** SQL Server instance with Maximum server memory set to highest value allowed.

**Indications that SQL Server Would Like More RAM**

**Example: SQL Server Process is Not Processing Entire Table in Memory**

Figure 5 is from a computer platform with a total of 9GB of RAM.

To run an ETL refresh of table E1132 (5.5GB) efficiently SQL Server should be using over 5.5GB. Instead, Task Manager is showing that SQL Server is just using 2.3GB. This implies that there was not enough RAM available to allocate to SQL Server or that something is preventing SQL from allocating more than 2.3GB.
ETL Refresh Performance: Memory, SQL Server & Data Warehouse Table Size

Tips:
- Check SQL Server memory allocation (see Figure 4 above).
- Reboot server and test again.

![Task Manager Screenshot](image)

Figure 5
Total Database Size

This section relates to the prior section: Recommendation #2: RAM for Best Performance Based on Total Database Size

Figure 6 The **Size** column shows the data space currently required by all the tables in the database.
Example: Heavy Disc Usage

When SQL Server doesn’t have enough RAM to cache large tables with formulas lots of disk IO will be displayed by Windows Resource Monitor. This usage can be observed while the ETL is processing a formula refresh on a large data set. Relatively high levels of disk usage and relatively low CPU utilization (a few %) will be observed.

Figure 7 Window’s Resource Monitor showing Disk utilization at about 50%.