IBM Cognos TM1 TI-Process Synchronization: Proven practices, Recommendations and a plug&play TI-Synchronization Utility

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1. TI-Process Synchronization - Introduction

For TI processes that edit/update dimensions and/or update security, it is a proven practice to implement of a Synchronization Methodology to serialize TI processing to prevent thrashing/rollback: Thrashing, or successive rollbacks and retries, can result from the concurrent execution of Turbo Integrator processes that lock the same objects and block each other. If two or more TI processes may perform an update of one and the same dimension, the first process to acquire the dimension 'lock' will block the other process from continuing, the 2nd process will hence do a rollback of its actions before encountering the lock and then will attempt to start anew (possibly hitting the same lock later should process 1 not have finished). Such two processes should be kept from being executed in parallel and instead should only be allowed to be run in serial to avoid thrashing and excessive rollback actions. The same applies to fact updates and dimension updates: if you are running a process that updates fact data you should not attempt to update the dimension master data using a different process as this will cause locking and rollbacks. Typically, a TI process will only perform actual updates at or towards the end of the process after 1st retrieving data and/or performing various validations, and if it then finds that the object it is trying to update is locked, then it performs a roll back and retry. In some cases, two or more TI-process may even enter into a 'loop' of multiple to endless rollbacks and retries due to locking one another during various stages of processing.

Thrashing Examples:

1. Two or more TI processes may perform an update of one and the same dimension
2. The first process to acquire the dimension 'lock' will block the other process from continuing
3. The 2nd process will hence do a rollback of its actions before encountering the lock and then will attempt to start anew
4. The 2nd process may possibly hit the same lock later should process 1 not have finished or have released the lock (again resulting in a roll-back, i.e. back to the beginning...).
5. Or the 2nd process will find that the lock was released, but: the 2nd TI process ,may obtain a lock on a different object that is needed by the first process (but later on, i.e. towards the end of the 1st process running
6. Now the 2nd process is locking the 1st process & the 1st process will do a roll-back...
7. Not only may there be roll-backs and retries, but the rollbacks and retries – depending on the TI procedures in place, may affect one another, resulting in two or more processes locking each other out.

The idea behind the synchronization and serialization logic is therefore to reduce if not eliminate thrashing inefficiencies by 'locking' the target object (or a common related object) upfront **before** retrieving data or performing any other time consuming operations. A semaphore logic can be used to synchronize certain (applicable) TI processes to run in serial execution mode only. The synchronization logic will ensure that a process is told to 'wait' at the very beginning of execution (before it would require a roll-back or data updates etc.) until the 'lock' that would prevent the process from continuing is released.

As of TM1 10, the SYNCHRONIZED()[1] function allows for easy serialization of TI processes if needed.

[1] TM1 SYNCHRONIZED() function: IBM® Cognos® TM1® TurboIntegrator (TI) function called synchronized() can be used in a TurboIntegrator script to force serial execution of a designated set of TurboIntegrator processes. The synchronized() function uses the following syntax: synchronized(string)
A TurboIntegrator process may make any number of calls to synchronized(), with any number of lock objects. Serializing is effective from the time synchronized() is called, until the containing transaction completes. For example, if synchronized() is called from a subprocess (Ps) of master process (Pm) or master chore (Cm), the Lock Object is "released" when Pm or Cm completes. The exception is that a SaveDataAll (SDA) prematurely "ends" a transaction mid-process execution; this applies to Lock Objects as well. The synchronized() call may be placed anywhere within a TurboIntegrator script, but serialization applies to the entire

2. Recommendations on how to use SYNCHRONIZED()

SYNCHRONIZED() takes a single required parameter that is a user-defined name for a lock object. This lock object name can be used in multiple TI-processes in order to serialize their execution as a group. A TI-process may make any number of calls to synchronized(), with any number of lock objects. Serializing is effective from the time synchronized() is called, until the containing transaction completes.

Recommended use of SYNCHRONZIED():

- Use **Dimension Names as the lock names for SYNCHRONIZED(**)
- For TI processes that are built specifically to updated a certain dimension, add the following code to the beginning of the TI process (TI prolog): **SYNCHRONIZED (<DimensionName>);**
- For TI-processes that update a cube, issue SYNCHRONIZED() calls for each of the cube's dimensions. If the TI is dynamic in terms of which cube it uses, use a WHILE loop with TABDIM to loop through each dimension and call SYNCHRONIZED(), like:

```
nFlag = 1;
nDimCounter = 1;
WHILE ( nFlag = 1 );
   sDimensionXName = '';
   sDimensionXName = TABDIM ( pSourceCube, DimCounter );
   IF ( sDimensionXName @<> '' );
      SYNCHRONIZED ( sDimensionXName );
   ELSE;
      nFlag = 0;
   ENDIF;
   nDimCounter = nDimCounter + 1;
 END;
```

- For TI processes that are parameterized such that multiple or varying cubes, dimensions or objects could be accessed and locked, implementation of a configurable TM1 **TI-Synchronization utility** is recommended. The utility is to leverage the SYNCHRONIZED() function in combination with a configurable Lookup model to allow setting, maintaining and testing different serialization configurations in an ad-hoc/dynamic fashion. Such a utility – which allows a plug&play implementation – is described in the following section.

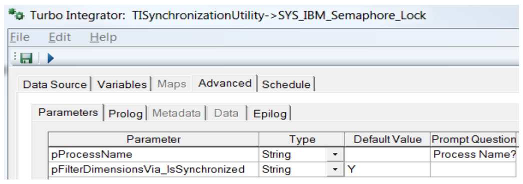
TurboIntegrator process when it is encountered.Consider a TurboIntegrator process with a synchronized() call somewhere in the "middle" of its script, and an operation O1 preceding that call. Two instances of this TurboIntegrator process may start at the same time. It is possible for one instance to run to completion, including its call to synchronized(), before the second instance reaches its synchronized() call. In this case, the two processes appear to the user to have run concurrently. If, instead, the second process does reach its synchronized() call before the first completes, it will undo any work it had done (O1) and wait for the first to complete. In this case, the two processes appear to the user to have serialized. To avoid such confusion, and to optimize the use of synchronized(), it is recommended (but not enforced) that synchronized() calls be the first statements of a TurboIntegrator process.

3. Configurable TI Synchronization Utility

The TM1 Utility leverages the SYNCHONIZED() function in combination with a configurable Lookup model to allow setting, maintaining and testing different serialization configurations in an ad-hoc/dynamic fashion. Here is how to implement the TM1 Asset for semaphore locking:

a) Drop the files from the attached archive in your TM1 data directory and restart the TM1 Database Process

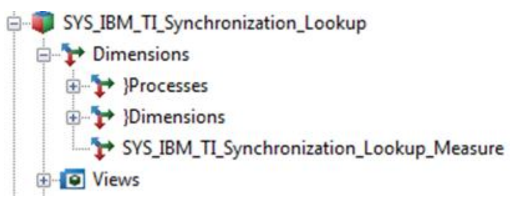
b) 'SYS_IBM_Semaphore_Lock.pro' should be invoked in the prolog of TI processes that shall be serialized with other specific or non-specific TI processes. Corresponding code to be inserted into the prolog of a TI process:
EXECUTEPROCESS ('SYS_IBM_Semaphore_Lock' , 'pProcessName' , GetprocessName());

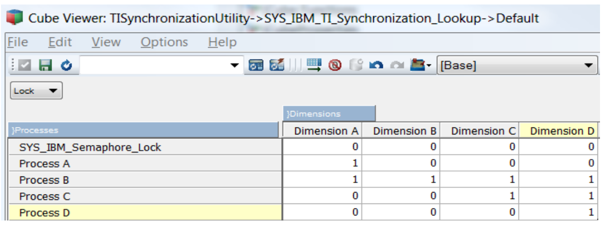


Parameter	Type	Default Value	Prompt Question
pProcessName	String		Process Name?
pFilterDimensionsVia_IsSynchronized	String	Y	

c) For dimension }Dimensions.dim, create an Attribute 'Is Synchronized'. Set the attribute value for Y for every dimension for which you want to implement serialization of dimension maintenance tasks.

d) The lookup cube 'SYS_IBM_TI_Synchronization_Lookup.cub' then is used to determine the SYNCHRONIZED() flags to be set by a specific TI process. The SYNCHONIZED flags are set by process 'SYS_IBM_Semaphore_Lock.pro'. Configure SYS_IBM_TI_Synchronization_Lookup.cub' such that for each TI process that shall be serialized, the cube value for the corresponding dimension (i.e. the dimension the TI will edit or lock) is set to 1.


SYS_IBM_TI_Synchronization_Lookup
Dimensions
}Processes
}Dimensions
SYS_IBM_TI_Synchronization_Lookup_Measure
Views


Cube Viewer: TISynchronizationUtility->SYS_IBM_TI_Synchronization_Lookup->Default
File
Edit
View
Options
Help
[Base]
Lock

}Processes	Dimension A	Dimension B	Dimension C	Dimension D
SYS_IBM_Semaphore_Lock	0	0	0	0
Process A	1	0	0	0
Process B	1	1	1	1
Process C	0	0	1	1
Process D	0	0	0	1

e) Sub-process 'SYS_IBM_Semaphore_Lock.pro' will now, via the lookup cube entries in 'SYS_IBM_TI_Synchronization_Lookup.cub' set SYNCHRONIZED(<DimensionName>) flags as follows:

i. Cube 'SYS_IBM_TI_Synchronization_Lookup.cub' will be queried for the specific process (with process = <processname> below). The process will query the 'Lock' value for applicable <processname>/<dimensions> combinations

ii. Depending on process parameter pFilterDimensionsVia_IsSynchronized:
- If pFilterDimensionsVia_IsSynchronized =N: with <dimensions> = all dimensions in }Dimensions.dim (i.e. If pFilterDimensionsVia_IsSynchronized = N or <> Y, all dimensions, i.e. all elements in }Dimensions.dim will be evaluated)
- if pFilterDimensionsVia_IsSynchronized = Y or <dimensions> = dimensions in }Dimensions.dim with value Y for attribute 'Is Synchronized' (i.e. If Parameter

pFilterDimensionsVia_IsSynchronized = Y a filter will be applied such that a synchronization flag is only going to be evaluated against dimensions where the }Dimensions.dim Attribute 'Is Synchronized' = Y (via an MDX subset).

ii. IF the 'Lock' value is 1, the process 'SYS_IBM_Semaphore_Lock.pro' will issue a synchronization semaphore flag <dimension> using the TM1 function SYNCHRONIZED(), i.e. SYNCHRONIZED (<dimension>) will be issued for each <processname>/<dimension> combination with value 'Lock' = 1, i.e. if needed, more than one synchronization flags can be issued by a process.

4. TI Synchronization Utility Objects

https://ibm.box.com/s/euluj72iqi9nga1yj52fklezvd2mu99l