MATERIALIZED VIEWS MANAGEMENT TECHNOLOGY BASED ON WORK SCHEDULE OF ORGANIZATIONS

Пропонується інформаційна технологія механізму управління періодично підключаємих матеріалізованих представлень (МП), яка заснована на розпорядку роботи організацій. Даний механізм управління включенням/виключенням матеріалізованих представлень, прив'язуючись до часів робочого дня/днях тижня/декаді/місяця дозволяє збільшити ефективність використання матеріалізованих представлень в інформаційних системах, що використовують реляційні системи управління базами даних

Ключові слова: інформаційні системи, продуктивність інформаційної системи, мова запитів, матеріалізовані представлення, запит

Предлагается информационная технология механизма управления периодически подключаемых материализованных представлений (МП), основанная на распорядке работы организации. Данный механизм управления включением/выключением материализованных представлений, привязываясь к часам рабочего дня/дням недели/декаде/месяца позволяет увеличить эффективность использования материализованных представлений в информационных системах, которые используют реляционные системы управления базами данных

Ключевые слова: информационные системы, производительность информационной системы, язык запросов, материализованные представления, запрос

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1. Introduction

There are various software methods of increasing the productivity of informational systems (IS) based on using of relational data bases (RDB). One of them anticipates using of materialized views (MV) [1 – 6]. MV stores result of certain request to the data base (DB) and at following entry of this request to the IS allows getting answer very fast. However the practical use of MV in separate IS is impossible without preliminary study of this IS. As MV is a result of request which uses number of BD tables the refreshing of certain data in those tables leads to necessity of refreshing MV too. At frequent refreshing of data the using of MV could not increase but decrease the effectiveness of IS [7].

In a books [8, 9] the way of determining of those requests for which the using of MV will be effective on the basis of RBD requests consequence analysis is shown. AT this we consider that MVs in future will be connected permanently.

In this book the periodical connection and disconnection of MV is offered.

The basis for this is an evident periodicity in resolving of different tasks for the most of organizations. For example, there is a period of admission, passing the tests, and visiting hours in the university. In trading companies the periodicity of goods income, residues inventories, revaluation and sales out, seasonal variations in assortment and working hours is observed. The periodicity of resolving of production objectives is reflected in periodicity of requests incoming to the system.

2. Advantages of MV management

Periodical connection/disconnection of MV will allow to increase its effectiveness due to following factors.

1. Possibility of disconnection of some MV during period when it's using is non-effective.

2. Possibility of initiation into service of MVs which became non-effective at continuous connection but which are effective during certain periods.

3. Lowering of DBMS resources spent for servicing of MV mechanism due to implementation of effective MVs at now only.

3. Reasoning about efficiency of MV

Let us assume that Q is a consequence of requests being sent to the IS during period of observation t_0. There are n_i requests of q_i form and of SELECT type in this consequence. To determine the possibility of forming MV for requests q_i, introduce the term «effectiveness Mpi» (materialized view for request q_i), specified as relation of all q_i requests execution time without implementation

of MV to the time of all q_i requests execution time with implementation of MV.

$$Ec_i = \frac{S0_i}{Smp_i + Snew_i + Ssel} , \qquad (1)$$

where $S0_i = \sum_{j=1}^{n_i} t_i$ — total time of all q_i requests execution during observation period t_0 without implementation of MV;

$Smp_i = n_i * t_{mpi}$ — total time of all q_i requests execution with implementation of MPi;

$Snew_i = ku_i * tu_i$ — time of MPi refreshes during t_0. Here ku_i is a quantity of MPi refreshes which is determined by number of UPDATE, INSERT and DELETE requests which changes the data in basic tables affecting the value of MPi.

tu_i - average time of refresh MPi.

$Ssel = n * n_{mp} * t_s$ - time being spent for choosing the requests having MV from common flow of requests. Here n is a quantity of all requests came into DB during time of observation t_0, n_{mp} is a quantity of MVs being used.

Let us introduce the term of effectiveness of managed implementation of MV. At this we will call the time interval during which Mpi is connected for the time $\tau1_i$ (connection period) and then is disconnected for the time $\tau0_i$ (disconnection period) as management period.

$$E\tau_i = \frac{S0_i}{Smp\tau_i + Snew\tau_i + Ssel\tau + Sbd} , \qquad (2)$$

where $Smp\tau_i$ is a total time for all q_i requests execution which are in periods $\tau1_i$.

$Snew\tau_i$ is a time of MPi refreshes during $\tau1_i$ periods.

$Ssel\tau = n * n\tau_{mp} * t_s$ is a time being spent for choosing the requests having MV from common flow of requests. Here $n\tau_{mp}$ is a quantity of MVs being implemented taking into account the introduction of connection/disconnection mode ($n\tau_{mp} < n_{mp}$).

$Sbd = (n_i - n\tau_i) * t_i$ is a time being spent for q_i requests execution which are not in $\tau1_i$ periods.

Let us introduce the term of maximum effectiveness of Mpi implementation calculated at condition that only those periods of observation are taken into account in it for which $E\tau_{ij} > 1$. Averaged value of such effectiveness's will be considered as maximum effectiveness of Mpi implementation.

$$E\tau\max_i = \sum_{j=1}^{m} E\tau_{ij} / m . \qquad (3)$$

4. Choosing of way of MV implementation

Value $E\tau\max_i$ plays role of upper limit of possible Mpi effectiveness and is a component of dependency of MV implementation effectiveness form the method of MV management specified in following rules.

1. If for some request q_i $Ec_i > 1$ and $E\tau\max_i > Ec_i$ then it is reasonable to search the periods of connection/disconnection of Mpi.

2. If for some request q_i $Ec_i > 1$ and $Ec_i \approx E\tau\max_i$ then it is no need to search the periods of connection/disconnection of Mpi, but need to connect the Mpi for all period of AS operation.

3. If for some request q_i $Ec_i < 1$ and $E\tau\max_i > Ec_i$ then it is reasonable to search the periods of connection/disconnection of Mpi.

4. If for some request q_i $Ec_i < 1$ and $E\tau\max_i < Ec_i$ then no sense in Mpi implementation.

5. Determining the parameters of MV management

Let`s consider as it is possible to find several effective periods of connection/disconnection for MPi where each of periods is specified by duration of connected and disconnected condition of MPi

$$\tau_{ij} = \tau1_{ij} + \tau0_{ij} .$$

For estimation of effectiveness of each certain MPi connection/disconnection period implementation the formula (4) is offered where numerator is determined by not all requests q_i but only those which are in connection periods Mpi. This allows assessment of effectiveness for each period having been found by separate.

$$E\tau_{ij} = \frac{S0\tau_{ij}}{Smp\tau_{ij} + Snew\tau_{ij} + Ssel\tau} . , \qquad (4)$$

here $S0\tau_{ij} = \sum_{r=1}^{n\tau_i} t_i$ is a total time of all q_i requests execution during periods $\tau1_{ij}$ without implementation of MV.

Relative assessment of some management period effectiveness $E\tau_{ij}$ is necessary for assessment of this period but not allow estimate the «deposit» of this period to total effectiveness Mpi. To estimate the «deposit» of each management period and determinate the end of new management periods search process let us to introduce the absolute estimates of effectiveness specified by reducing the time for requests execution.

In accordance with (1) we will obtain reducing of time at constant connection of Mpi - Δtc_i.

In accordance with (3) we will obtain maximum reducing of time at selective connection Mpi- $\Delta t\max_i$.

In accordance with (4) we will obtain reducing of time at choice of certain management period Mpi- $\Delta t\tau_{ij}$.

The basis of management periods and corresponding connection $\tau1_{ij}$ and disconnection $\tau0_{ij}$ periods search method is a repetitive process which ends when value of total reducing of time at periodical management Mpi

$$\Delta t_i = \sum_{j}^{m} \Delta t\tau_{ij} \cong \Delta t\max_i , \qquad (5)$$

or there is no possibility for addition of new management periods, for example, increasing m is impossible for existing value of observation time t_0.

6. Determination of management periods on the basis of work schedule of organization

In real informational system the periods of MV management could be linked with work schedule of organization that is to the working hours, day of week, date of month and so on. In addition, depending on particular characteristics of organization profile the specialized methods could be in-

troduced, for example, 3 days before each month end, 5 days before each quarter end etc.

On the basis of IS operation analysis and convenience of MV management it is convenient to choose one hour as the shortest period of connection. Let us to introduce the numbering of IS working hours from the moment of beginning of working day. Based on the above the first period of management is offered to be set the week and period of connected state Mpi is a first hour of Monday. Then with saving of management period we set the connection period Mpi as second hour of Monday and so on. While process continue all hours of each day of the week are processed consequently with saving the period which is equal one week.

For each day an hour on the basis of (4) the effectiveness is calculated

$$E\tau_{iWeek,Dj,Hk} = (\sum_{1}^{n} E\tau_{iDj,Hk}) / n ,$$

where n is a quantity of weeks entered in observation period,

Dj is a day of week,

Hk is a number of hour of working day.

The days and hours used for calculation of three values of effectiveness $E\tau_{iWeek,Monday,1}$ $E\tau_{iWeek,Tuesday,3}$ $E\tau_{iWeek,wednesday,4}$ are specified in tabl. 1.

Table 1

Management period is a week

Hour	Week							Week							Week...		
	Mn	Tu	Wd	Th	Fr	Sa	Sn	Mn	Tu	Wd	Th	Fr	Sa	Sn	Mn	Tu	Wd
1	■	-	-	-	-	-	-	■	-	-	-	-	-	-	■	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	■	-	-	-	-	-	-	■	-	-	-	-	-	-	■	-
4	-	-	■	-	-	-	-	-	-	■	-	-	-	-	-	-	■
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

The results of calculations are convenient to be represent in view of matrix of management Mpi, where each cell has 0 (corresponds to value $E\tau_{iWeek,D,H} \leq 1$) or 1 (corresponds to value $E\tau_{iWeek,D,H} > 1$).

There is a conclusion from tabl. 2 particularly which MPi could be connected in Monday during 1st and 2nd hour as well as during 6, 7 and 8 hour.

Table 2

Management of Mpi on the basis of weekly analysis

Hours	Days of week						
	Mn	Tu	Wd	Th	Fr	Sa	Sn
1	1	0	1	0	1	0	0
2	1	1	1	0	0	1	0
3	0	0	1	1	0	0	0
4	0	0	0	0	1	0	0
5	0	0	0	0	0	0	0
6	1	0	1	0	0	0	0
7	1	0	1	0	0	0	0
8	1	0	0	1	0	0	0

Introduction of new more long periods of management allows correction of obtained tables of management MPi.

Consider how to take into account possible periodicity of requests concerned with decades of month.

If earlier the averaging of effectiveness by weeks were performed independently of arrangement of certain week in month (first or last) then now averaging is performed by each of decades. For each of decades, day of week and hour the effectiveness is calculated, where n is a quantity of days Dj entered in period of observation, l – number of decade.

The results of decades analysis are shown in tabl. 3 fragmentally.

Table 3

Management Mpi on the basis of analysis by decades

Hours	Decade 1				Decade 2				Decade 3			
	....	Mn	Tu	....	....	Mn	Tu	....	....	Mn	Tu	....
1	....	1	0	....	....	1	0	....	....	1	1	....
2	....	1	0	....	....	1	0	....	....	1	1	....
3	....	0	0	....	....	0	0	....	....	1	0	....
4	....	0	0	....	....	0	0	....	....	0	0	....
5	....	0	0	....	....	0	0	....	....	1	0	....
6	....	1	0	....	....	1	0	....	....	1	0	....
7	....	1	0	....	....	1	0	....	....	1	0	....
8	....	1	0	....	....	1	0	....	....	1	0	....

The correcting of management MPi taking into consideration of study of more long-time management period.

Limitation for duration of management period being analyzed is made by observation time t_0 for operation of AS. It is recommended to limit the duration of longest management period by value of $t_0 / 2$.

This assessment together with (5) is a condition of new management periods search process end.

The duration of management period could be increased according to the results of observation for IS during time of system maintenance at condition of continue of requests consequence studying.

7. Conclusion

The analysis of requests consequence came into automation system having been performed had allow determine the requests which are profitable to connect at constant basis and other requests should be connected periodically.

Total time of requests execution was decreased. MVs being connected periodically in period of intense reports preparation allows avoiding of peak loads on the system.

Developed method of MV management could be used in many organizations where the certain periodicity of tasks being executed is observed.

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МЕТОДИКА ОБОСНОВАНИЯ ОРГАНИЗАЦИОННО-ТЕХНИЧЕСКИХ МЕРОПРИЯТИЙ ПО СОВЕРШЕНСТВОВАНИЮ ЭКСПЛУАТАЦИИ КОРАБЕЛЬНОЙ ТЕХНИКИ

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Пропонується методика обґрунтування практичних рекомендацій щодо удосконалення процесів експлуатації корабельних технічних засобів шляхом оцінки ефективності та безпеки зазначеннях процесів. Дана методика дозволяє врахувати безліч технічних станів корабельної техніки, а також спільно кількісно оцінити можливості виникнення аварійних ситуацій і їх попередження

Ключові слова: ефективність, безпека, корабельні технічні засоби, ВМС України, процес експлуатації, аварійність

Предлагается методика обоснования практических рекомендаций по совершенствованию процессов эксплуатации корабельных технических средств путем оценки эффективности и безопасности указанных процессов. Данная методика позволяет учесть множество технических состояний корабельной техники, а также совместно количественно оценить возможности возникновения аварийных ситуаций и их предупреждения

Ключевые слова: эффективность, безопасность, корабельные технические средства, ВМС Украины, процесс эксплуатации, аварийность

1. Введение

Проблема аварийности и ее предупреждения остро стоит перед всеми флотами мира. Особенно эта про-блема актуальна для кораблей и судов Военно-Морских Сил Вооруженных Сил Украины (далее – ВМС Украины), так как у большинства из них закончились нормативные сроки эксплуатации. Проблема также