The Design and Application of Parallel Dispatching Technology in the Process of Generating Bank Risk Index Metering Report

Chunyan Xue
Xiamen Univercity Tan Kah Kee College, Xiamen,363005, China
Email: 380040211@qq.com

Abstract: In this paper, in order to meet the risk measurement requirements of commercial banks, the parallel scheduling strategy analyses the configuration report at a time, schedules network tasks parallel, saves key node data and other technical strategies, makes full use of reusing of the indicators and the intermediate results in the calculation process. Thereby the technology reduces the calculate amount of the valuation, increases the efficiency of the calculation and reduces the burden on the system's large data operations.

1. Technical Background
With the continuous development of commercial banking financial market business, the type and quantity of products have increased dramatically, and the corresponding requirements of market risk management are getting higher and higher. The core of market risk measurement is to generate various measurement results according to the configuration of the report.

The traditional risk measurement system adopts the serial scheduling scheme starts from the single report configuration, processes the position range and index definition of the report configuration, and then generates the corresponding position data and scenario data, and then sends the data to the evaluation module and returning the result of the valuation and generates the report, finally read each report in turn, cycle above operations. This method needs to call the valuation module several times during the process of checking out. In the process of calculation, it needs to interact with the market database several times and call the scene data processing module repeatedly. The hardware resource consumption is larger and the redundancy calculation items are more, the calculation efficiency is lower.

In this paper, the parallel scheduling technology can be a one-time read more than one report configuration, and gradual split the generated computing tasks, The calculation task for business coincidence is not further dismantled, and the result of the previous calculation is used directly. The technique splits the data several times until the task unit of the smallest dimension is generated. The parallel scheduling technology greatly reduces the redundancy problem of the same task in the traditional scheduling scheme and the large interaction with the data mart and the valuation module, so as to improve the efficiency of the system calculation and reduce the burden of the large data operation.

2. Design of Parallel Scheduling Technology
Parallel scheduling technology is designed as follows:
Figure 1 Parallel scheduling scheme process
2.1 Read the configuration information for multiple reports one time
Parallel scheduling technology starts from the configuration of the report, read multiple statements of the configuration information one-time, define a batch of range of positions in all reports and indicators to be calculated, summary, teases and merges the basic computing tasks (the first layer of computing tasks in figure 1, but also the final display of the index value required for the calculation of the task).

2.2 Resolve the report configuration to generate the most simple value call task
The technology decomposes the basic computing tasks according to the indicators of the dependencies and indicators summarized business logic: such as the basic computing tasks involved in the index A (such as the calculation of a position of the MVaR indicators) can be decomposed into the next level of calculation indicators B (calculate the VaR value of the parent node of the position) and calculate the index C (calculate the VaR value of the combination after the removal of the position), and the second layer of the calculation task is likely to do further subdivision, Step down until you cannot break down. All the detailed calculation of the task can be merged, through the task of the merger it will be able to get a mesh task scheduling structure.

After getting the most detailed calculation unit, the technology batch processing of the scene data, to avoid multiple accessing the database for data read and write operations, optimize the efficiency of the operation.

2.3 Reverse the index and generate a report based on the results returned by the valuation
After the completion of the scene data processing, the technology call the valuation module for the calculation of the most detailed calculation unit, and then in accordance with the previous split and merge the relationship between the final report to restore the results required to display the results, and save the calculation of the key nodes in the task scheduling network. The results are used to calculate the reuse of indicators in different batches in the future.

2.4 Application of Parallel Scheduling Technology in Bank Risk Measurement System
The concise chart of a commercial bank risk measurement system is as follows:
1) The technology reads the configuration of multiple reports at one time, generates the thinnest computing unit based on the dependencies between the calculated items, reduces the number of scenario data generated by the scenario generator and reduces the number of scenario data The number of interactions;
2) From the indicator calculator module to the report processing module, the technology uses the previously established scheduling strategy to restore the calculation results of the basic calculation unit so that the final output index calculation results meet the business requirements.

3. Implementation of Concurrent Dispatching Technology
1) The technology configures all reports in one time to generate a basic computing task unit
2) The technology teases the basic task unit and subdivides the task unit down to the point where it cannot be broken down.
3) The technique combines the task unit to generate the smallest task unit of the valuation module.
4) The technology from the merged after the smallest task unit, according to the indicators group the calculation tasks.
5) The technology imports the smallest task unit into the scenario generator, generate the scene data.
6) The technology carries out the valuation of the position file and the scenario data file involved in the finest task unit.
7) The technique returns the valuation results from the various scenarios returned by the valuation engine to the indicator calculator and processes the indicator results of the finest dimension calculation task unit.
8) This technique reverses engineer the results of the thinning calculation task unit according to the order of step 2 and step 3 to generate the index result of the basic calculation task unit and summarize it. In this process, the results of the calculation of the indicators on the key nodes are stored for the reuse of indicators between different batches.

4. Efficiency Analysis of Concurrent Dispatching Technology
The parallel scheduling strategy makes full use of the dependencies between the indexes and reuses the intermediate results of the index machines, thus reducing the calculation of the valuations and increasing the efficiency of the calculation. The core step is to recursively perform the task decomposition according to the business dependency between the indicators, thus establishing the network scheduling structure. In the parallel scheduling technology, there are many indicators of business dependency is split through the position of the data after the structure, the current standard scheduling program is usually used in the standard format of the position data call valuation module for valuation calculation, it makes the number of dependencies between the calculated indicators smaller; the number of dependencies in the indexing module calculated by the parallel dispatching technique is large and the efficiency is improved. The specific analysis is as follows:

It is shown that computing efficiency the parallel scheduling scheme is more than the traditional scheduling scheme:

Example: 50 existing reports need to be configured, each report has 30 same indicators, the scope of each report is different, a total of non-repeat the number of positions is 10,000.

In accordance with the traditional scheduling program, the system first read the first report, according to Figure 1 shown in the database interaction, call valuation module, generate the final report, and read the 50 reports in turn. Throughout the task process, the technology did 1500 database interactions, calls 50 evaluation modules, get 15000000 valuation, then results in 1500 scenario files.

According to the scheduling scheme adopted by the parallel scheduling technology, the system will read 50 report configurations at one time, and then perform several iterations according to the configuration split calculation task until the 15 smallest dimensions task are obtained. (The position calculation of each indicator will produce 30 calculation tasks, assuming that the dependency of the index will be reduced about half of the calculation task). The task of the 15 smallest dimensions of the task calculation unit as shown in Figure 2, the database interaction, the valuation module calls to generate the smallest dimension of the corresponding indicators, according to the previous split back to the first generation of 50 statements. The next step is to exchange the data of the 15 task computing unit in accordance with the flow chart 2 , call the valuation module to generate the smallest dimension of the indicators, 50 reports are generated in reverse order according to the previous split step. The entire task process carried out 15 database interactions (99% reduction in the number of interactions), called a valuation module (98% reduction in the number of interactions), and 150000 evaluations (99% reduction in valuation), resulted 15 scenario files (99% reduction in redundant scenario data files).
### Database interaction times

| Scheme                        | Database interaction times | Number of valuation module calls | Number of valuations | Number of scene files |
|-------------------------------|----------------------------|----------------------------------|-----------------------|-----------------------|
| Traditional scheduling scheme| 1500                       | 50                               | 15000000              | 1500                  |
| Concurrent scheduling scheme  | 15                         | 1                                | 150000                | 15                    |

**Figure 3. Efficiency Analysis of Concurrent Dispatching Technology**

### 5 Conclusion

The parallel scheduling technique described in this paper uses the one-time batch read report configuration and the overall scheduling strategy to be analyzed at the same time, which significantly reduces the number of times of interaction with the valuation module and data mart, and reduces the number of times of repeated calculation, thus optimizing the operation of the performance, saving the system checkout time, reduce the consumption of hardware resources.

The scheduling strategy of the mesh task used in the parallel scheduling technology improves the multiplexing probability of the calculation task, reduces the number of calling to the evaluation module, reduces the number of processing of the scenario data, and avoids the problem of generating a large amount of redundant data, further enhances the system's computing performance.

The parallel scheduling technique stores the settlement result returned by the key computing task unit, makes it possible to reuse the calculation result of the index between the different batches, further improve the multiplexing probability of the calculation task, and it is difficult to configure some of the original Of the demand for indicators (some of which are calculated by the different batches of settlement operations). It provides convenience for some of the metrics that were originally difficult to configure at the interface (some of the metrics that related to the different batches of billing operations).

### References

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