

SQL Report Benjamin Gaylard

by Benjamin Gaylard

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1. SQL Performance Tuning

1.1. Introduction

SQL performance tuning is a process of optimizing the performance of a database management system. There are several types of SQL performance tuning that can be used to improve the performance and scalability of a database.

1.2. Different types of SQL Performance Tuning

1.2.1. Index tuning

Index tuning is one of the most important types of SQL performance tuning. Indexes are used to improve the performance of queries by allowing the database management system to quickly find and retrieve the data that is needed. Creating and maintaining indexes is an essential part of SQL performance tuning [1].

1.2.2. Query tuning

Query tuning is another important type of SQL performance tuning. This involves optimizing the structure and syntax of SQL queries to improve their performance. This can be done by using the correct join types, using indexes, and by avoiding unnecessary subqueries [2].

1.2.3. Schema tuning

Schema tuning is another important type of SQL performance tuning. This involves modifying the database schema to improve performance and scalability. This can be done by normalizing the data, using appropriate data types, and by partitioning large tables [3].

1.2.4. Configuration tuning

Configuration tuning is another type of SQL performance tuning. This involves adjusting the configuration settings of the database management system to optimize performance. This can be done by adjusting settings such as the buffer cache size and the number of concurrent connections [1].

1.2.5. Server tuning

Server tuning is another type of SQL performance tuning. This involves optimizing the server hardware and operating system to improve performance. This can be done by adjusting the server's memory and CPU settings, and by optimizing the file system [4].

1.2.6. Network tuning

Network tuning is another type of SQL performance tuning. This involves optimizing the network configuration to improve communication between the application and the database. This can be done by adjusting the network settings, such as the TCP/IP settings and the DNS settings [1].

1.2.7. SQL profiling

SQL Profiling is another type of SQL performance tuning. This involves analysing the performance of individual queries and identifying bottlenecks. This can be done by using tools such as the SQL profiler in SQL Server or the Oracle SQL Developer [2]r.

1.2.8. Explain

Explain Plan is another type of SQL performance tuning. This involves analysing the execution plan of a query and identifying the most expensive operations. This can be done by using tools such as the EXPLAIN PLAN in Oracle or the SHOW PLAN in SQL Server.

1.2.9. Load testing

Load testing is another type of SQL performance tuning. This involves evaluating the performance of the system under various workloads. This can be done by using tools such as Apache JMeter or Gatling.

1.2.10. Memory tuning

Memory tuning is another type of SQL performance tuning. This involves adjusting the memory configuration to improve performance. This can be done by adjusting the memory settings such as the buffer cache size and the shared pool size [5].

1.3. Advantages and disadvantages of SQL performance tuning

SQL performance tuning can provide a number of advantages for a database system, including:

- **Improved performance:**
By identifying and addressing issues that can cause slow performance in an SQL database, it is possible to significantly improve the overall performance of the system. This can result in faster query times and a better overall user experience [6].
- **Increased scalability:**
A well-tuned database can handle a larger workload without experiencing performance degradation. This can be particularly important for systems that are expected to grow over time [7].
- **Improved efficiency:** By optimizing the way that the database accesses and processes data, it is possible to reduce the number of resources that are required to run the system. This can result in cost savings and better overall efficiency [6].

However, there are also some potential disadvantages to SQL performance tuning:

- **Time and effort:** Tuning the performance of an SQL database can be a complex and time-consuming process, requiring a thorough understanding of the database design, hardware and software, and workload [6].
- **Limited improvement:** In some cases, the performance of an SQL database may be limited by factors such as hardware constraints or the workload being placed on the system. In these cases, it may be difficult to achieve significant performance improvements through tuning alone [5].
- **Over-optimization:** It is possible to spend too much time and effort trying to optimize the performance of an SQL database, resulting in a situation where the benefits of the tuning do not justify the time and resources that were invested [5].

Overall, SQL performance tuning can provide significant benefits for a database system, but it is important to carefully consider the potential costs and benefits before embarking on a tuning effort.

1.4. What is the explain command?

The EXPLAIN command is a tool in SQL that allows you to see how a database will execute a particular query. When you run EXPLAIN followed by a SELECT, INSERT, UPDATE, DELETE, or REPLACE statement, the database will return a set of rows that describe the execution plan for the query [5].

The EXPLAIN output provides information about how the database will access the data it needs to execute the query, including the tables and indexes that will be used and the type of join that will be performed. This information can be useful for identifying issues that may be causing slow performance, such as the use of full table scans or the lack of indexes on columns that are being searched. [4]

For example, consider the following simple SELECT statement:

```
EXPLAIN SELECT * FROM users WHERE username = 'jane';
```

The EXPLAIN output for this query might look something like this:

```
id  select_type  table  type  possible_keys  key  key_len  ref  rows  Extra
1   SIMPLE      users  ref   username       username 4      const 1    Using
where
```

This output shows that the database will use a simple index scan to access the rows in the users table that match the condition username = 'jane'. It also shows that the username column has an index, and that this index will be used to perform the search.

You can use the EXPLAIN output to identify areas where you may be able to improve the performance of your queries. For example, if you see that a full table scan is being used, you may want to consider adding an index to the columns that are being searched to allow the database to access the data more quickly.

2. Fragmentation

2.1. Introduction

Fragmentation is the process of dividing a database table into lower pieces to ameliorate system effectiveness and scalability. Three forms of fragmentation may be distinguished vertical, perpendicular, and mixed.

2.2. 3 main types of Fragmentation

2.2.1. Horizontal fragmentation

To scrap a table horizontally, a collection of predicates, or where conditions, are used to resolve the table into lower tables. Subsets of the original table's rows that satisfy the given predicates are contained in the lower, so-called fractured tables [8].

A SQL database's effectiveness and scalability may be increased by using vertical fragmentation, which makes it easier for the system to manage enormous volumes of data. also, it can be helpful for dispersing data among several waiters or for adding the effectiveness of specific kinds of queries. To avoid extravagant or ineffective fragmentation, it's pivotal to precisely assay the predicates that will be utilised to produce the pieces [9].

If a retail establishment has a significant number of customers, it would make sense to horizontally partition the "guests" table based on the client's home state. For example, if the shop has a lot of guests who live in California and New York, the predicates used to induce the fractions may be "state = 'CA'" and "state = 'NY'," respectively. This would result in the creation of two separate tables, one for guests in California and one for guests in New York.

2.2.2. Vertical fragmentation

By dividing a table into smaller tables according to the columns, or fields, that make up the table, vertical fragmentation is achieved. Subsets of the columns from the initial table are contained in the smaller tables, or fragments [10].

Vertical fragmentation can be used to improve the performance and scalability of a SQL database by reducing the amount of data that needs to be read or processed for certain queries. It may also be used to decrease storage requirements and enhance the efficiency of certain query features. However, it is important to carefully analyse the fields used to create the fragments, as using the wrong fields may result in excessive or ineffective fragmentation [10].

For example, if the "guests" table contains a high number of columns and not all of them are frequently accessed, it may make sense to vertically divide the table by separating out the less frequently accessed columns into a new table. For example, the "guests" table may be split into two tables, one with the most frequently accessed columns (such as "name," "address," and "phone number") and another with the less frequently accessed fields (such as "email," "username," and "date of birth").

2.2.3. Mixed fragmentation

Mixed fragmentation in SQL databases involves combining both vertical and horizontal fragmentation techniques. It involves dividing a table into smaller tables based on a combination of predicates (vertical fragmentation) and columns (horizontal fragmentation). The smaller tables, called fragments, contain subsets of both the rows and columns from the initial table [11].

Mixed fragmentation can be used to improve the performance and scalability of a SQL database in a similar way to vertical and horizontal fragmentation. It allows the system to more efficiently manage large amounts of data and can also be useful for distributing data across multiple servers or for optimizing the effectiveness of certain types of queries. However, it is important to carefully choose the combination of predicates and columns used to form the fragments, as using the wrong combination can result in hindered or ineffective fragmentation [8].

For example, consider a table called "guests" that stores information about customers of a retail store. The table could be horizontally partitioned based on the country in which the customer lives and vertically partitioned based on the attributes that make up the table. This would result in multiple smaller tables, each containing a subset of the columns from the initial "guests" table and only containing customers from a specific country.

2.3. Advantages and disadvantages of using Fragmentation in SQL databases

Fragmentation can be a useful tool for perfecting the performance and scalability of a SQL database by dividing large tables into lower, more manageable pieces. Still, it's important to precisely consider the implicit advantages and disadvantages of using fragmentation in a database system.

Some of the implicit advantages of using fragmentation in a SQL database include

- **Improved performance:**
Fragmentation can ameliorate the interpretation of certain manners of inquiries by allowing the system to more fluently access and process lower quantities of data. For illustration, if a table is horizontally disintegrated grounded on a predicate that's constantly exercised in inquiries, the system may be suitable to recoup the applicable data more snappily from the applicable scrap preferably than having to probe through the exclusive table [12].
- **Improved scalability:**
Fragmentation can ameliorate the scalability of a database by allowing it to more fluently manage voluminous quantities of data. By divorcing a voluminous table into lower fractions, the system can more fluently distribute the data across multitudinous waiters and manage an adding measure of data without passing interpretation declination [12].
- **Improved efficiency:**
Fragmentation can ameliorate the effectiveness of certain manners of inquiries by allowing the system to only pierce the data that's applicable to the query. For illustration, if a table is vertically fractured and a query only needs to pierce a fragile number of lines, the system can recoup the data from the applicable scrap preferably than having to recoup all of the lines from the initial table [12].

Still, there are also some implicit disadvantages to utilizing fragmentation in a SQL database, involving:

- **swelled complication:**
Fragmentation can append complication to a database system by taking the system to take and conserve multitudinous fractions. This can boost the outflow needed to achieve certain manners of inquiries and may also boost the threat of data inconsistencies or crimes [12].
- **dropped interpretation :**
In some cases, fragmentation can really drop the interpretation of a database system. For illustration, if the predicates or attributes exercised to form the fractions aren't taken precisely, the system may have to achieve fresh work to recoup the applicable data from multitudinous fractions, which can decelerate down inquiries [12].
- **swelled storehouse conditions:**
Fragmentation can boost the storehouse conditions of a database system by taking fresh tables to store the fractions. This can be a personal company if the fractions are much lower than the initial table, as the system may need to store a voluminous number of fractions to store the same quantum of data [12].

3. References

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GRADEMARK REPORT

FINAL GRADE

45/100

GENERAL COMMENTS

Instructor

Hi Benjamin,

You got 45% which is a good enough to pass the course work however there are lots of area that needs improvement as listed below:

1.
I would recommend you to start attempting your questions as soon as its released. By this way you would be able to manage time that will help you to attempt all the sections.
2.
You have included too many generic descriptions about performance tuning and fragmentation in the report. The report must summarize the approach that you have taken to complete the tasks, with the channellings and the ways in which they were tackled. In the SQL file, there was mismatch observed in the tables created and the insert statements, that led to several anamolies. Screen dumps were not substantiating enough to see the correctness of check constraints
3. Some of the key sections like ERD and clustered indexing were not attempted. The steps showing the normalization process upto the 3NF could have been a good justification for the created tables.
4.
Please go through the learning materials that are available in the Moodle pertaining to these concepts for a better understanding.
5.
Referencing and Citations are vital in report writing. I would recommend you to cite atleast a

minimal number of credible references such as
Books, Journals and conference
proceedings that are relevant to the tasks.

I hope you will find
these comments useful.

Should you have any
questions let me know

All the Best

Regards

Divya

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