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Understanding Indexes, Primary Keys, Secondary Keys, Composite Keys, and Their Role in Web-Based Application Performance

Saima Arora

MCA Student, Semester -2, Jagan Institute of Management Studies, Rohini Sector-5, Near Rithala Metro Station, New Delhi

ABSTRACT:

Technological advancements, in today's highly complex and complicated business world are playing a crucial role in the management of the databases. These databases are designed to provide the information based on the stored data in the database in a timely and an efficient manner. However, in order to provide information in an efficient manner, it must ensure that the data is retrieved quickly from the database where it is stored. It is in these crucial aspects that role of indexes and keys play a crucial role. This paper discusses these aspects.

Introduction

The business world of today is highly dependent on the databases. These databases are the backbone of the information systems. An information system is web based or an app based software which has three components comprising of user interface, the logic layer and the database.

The user interface is designed to interact with the customer and to capture the information which is put into the system as a response to the display contents in the user interface. These user interface play a crucial role in ensuring the capture of the details entered by the user and as such careful attention is required to the process of design of the user interfaces. Also, a user interface is used to display the processed information from the data which is stored in the databases.

The logic layer is concerned with the execution of the process algorithms on the data which was captured during the user interaction as well as from the data retrieved from the database. This is also one of the most important components of the information systems. Any error in the logic results in a disastrous consequences.

The database is the base of any software systems as it keeps the information entered by the user. The design of the database is crucial to ensure the reliability and the efficient working of the system. These databases provide the requisite information quickly and in an efficient manner through the concept of indexes and keys.

This paper discusses the concept of keys and indexes

Literature Survey

A database is the most important component of any computer-based system. It serves the core functions of data storage and data retrieval (Stephens, J., & Russell, C. (2004). However, during the development of the database, there are other issues which need to be taken into consideration so as to ensure that database continues to function in an optimal manner. This includes the aspects of design of the database to reduce the duplicity of the storage of information systems through the process of normalization, retrieval of information through keys and indexes (Miller, C. (1989); Lightstone, S. S., Teorey, T. J., & Nadeau, T. (2010); Graefe, G., & Kuno, H. (2010, March).

Further, when designing relational databases, we are required to ensure these basic concepts are required into consideration. A relational database works on the concept of normalization and primary and secondary keys (Churcher, C. (2012); Akinwale, A. T., Folorunso, O., & Sodiya, A. S. (2011).

Designing the databases

In order to understand the concept of indexes and keys, let us take an example of Library management information system. Any information system comprises of three major components. They are

- **User Interface Layer**: This is the layer which interacts with the user. These interfaces are built using HTML, CSS, JavaScript, and the bootstrap. This is the layer which is used to capture the information provided to the system and is stored in the database *which is designed by using the principles of normalization and primary and secondary keys.*
- **The logic layer**: This is the layer which is responsible for generating the logic controls of the system. For example, in the library management system the logic layer is used to validate the roll number of the student, the book number of the book issued to the student based on his roll number.
- **Database Layer**: This is the layer which stores and retrieves the data entered by the user.

Methodology for designing the database

Designing a database is cumbersome and complex. This involves the aspects of the application of the following points

a) **Requirement Gathering**: This is the most important step while designing the databases. In essence this includes the aspects such as the database growth size, the number of users, the number of changes and modifications, the type of the software which is being used. For example, in the case of Library management system, the number of students, the teachers, and alumni who would actually be using the system. Further, the number of changes to the software for example, addition of tables or the deletion of tables and other aspects such as keys and indexes used for retrieving the information.

b) **Database Design**: Once the points are taken care off, the next step is the logical design of the database along with keys and indexes to link the tables. This includes the aspects of creation of ER diagrams, application of normalization principles and the other aspects of the designing the databases

c) **Implementation**: Once the above are taken care, the database is actually created physically on the server and is tested thoroughly to ensure the accuracy and completeness of the database based on the requirements

d) **Testing**: The database is then connected with the application software and is tested for any defects or errors if any.

An Example of Key Components in Database Design

The following summarizes how keys and indexes were used in the project:

Table Name	**Key Used**	**Description**
students	Primary Key (student_id)	Uniquely identifies each student
teachers	Primary Key (teacher_id)	Identifies individual teachers
Book code	Primary Key (book_id)	Each book has a unique code
student_courses	Composite Key (student_id, course_id)	Prevents duplicate enrollments
teacher_subjects	Composite Key (teacher_id, subject_id, course_id)	Links a teacher to a course and subject
attendance	Primary Key (attendance_id)	Unique ID for each attendance record
	Foreign Keys	Enforce referential integrity between tables
	Indexes	Added to fields like name, email, and foreign key columns to speed up searches

Conclusion

Keys and indexes play a foundational role in database design and system performance. Hence, any lapse in the construction of keys and indexes will result in a disaster on *account of the fact that will fail to deliver the expected results.* For example, if a student queries for a particular book, it will take almost 3 hours to retrieve the book and it may generate the correct result

References

- Stephens, J., & Russell, C. (2004). Keys, Indexes, and Normalization. In *Beginning MySQL Database Design and Optimization: From Novice to Professional* (pp. 113-170). Berkeley, CA: Apress.
- Miller, C. (1989). Databases. *RQ*, *28*(4), 549-555.

- Lightstone, S. S., Teorey, T. J., & Nadeau, T. (2010). *Physical Database Design: the database professional's guide to exploiting indexes, views, storage, and more*. Morgan Kaufmann.
- Adaptive indexing for relational keys. In *2010 IEEE 26th International Conference on Data Engineering Work*
- Churcher, C. (2012). Normalization. In *Beginning Database Design: From Novice to Professional* (pp. 113-127). Berkeley, CA: Apress.
- Akinwale, A. T., Folorunso, O., & Sodiya, A. S. (2011). Derivation of Database Keys' Operations. *Issues in Informing Science and Information Technology*, *8*, 277-291.