

DATABASE MODELS AND THE ENTITY-RELATIONSHIP MODEL

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ABSTRACT	KEYWORDS
<p>This article analyzes the types of data models that form the basis of database management systems (DBMSs) and their principles of operation. In particular, the components of the Entity-Relationship (ER) model, which is the first and most important stage of database design, the attribute hierarchy and logical relationships between objects are discussed in detail. The article shows the importance of models in reducing errors and ensuring data integrity during the design process.</p>	<p>Database, Relational model, ER-model, Entity, Attribute, Relationship, SQL, Data hierarchy, Database design.</p>

Introduction

Annotasiya. Ushbu maqolada ma'lumotlar bazasini boshqarish tizimlarining (MBBT) asosi bo'lgan ma'lumotlar modellarining turlari va ularning ishlash prinsiplari tahlil qilinadi. Ayniqsa, ma'lumotlar bazasini loyihalashning dastlabki va eng muhim bosqichi bo'lgan "Mohiyat-aloqa" (ER) modelining tarkibiy qismlari, atributlar ierarxiyasi va ob'ektlar o'rtasidagi mantiqiy bog'lanishlar batafsil yoritilgan. Maqola loyihalash jarayonida xatoliklarni kamaytirish va ma'lumotlar yaxlitligini ta'minlashda modellarning ahamiyatini ko'rsatib beradi.

Kalit so'zlar. Ma'lumotlar bazasi, Relyatsion model, ER-model, Mohiyat, Atribut, Bog'lanishlar (Relationship), SQL, Ma'lumotlar ierarxiyasi, Ma'lumotlar bazasini loyihalash.

Аннотация

В данной статье анализируются типы моделей данных, лежащие в основе систем управления базами данных (СУБД), и принципы их работы. В частности, подробно рассматриваются компоненты модели «сущность-связь» (ER-модели), являющейся первым и наиболее важным этапом проектирования базы данных, иерархия атрибутов и логические связи между объектами. В статье показана важность моделей в снижении количества ошибок и обеспечении целостности данных в процессе проектирования.

Ключевые слова. База данных, Реляционная модель, ER-модель, Сущность, Атрибут, Связь, SQL, Иерархия данных, Проектирование базы данных.

The rapid growth of information flows in the modern world requires the creation of systems not only for storing information, but also for its effective management. Today, the success of any large enterprise, government institution or small business project directly depends on how correctly its information system is built. And the database (DB) is the heart of these systems.

However, the process of creating a database is not just about entering data into the system. The most important stage of this process is the design of the data structure. According to statistics, the majority of errors in information systems occur precisely as a result of shortcomings at the design stage, that is, incorrect establishment of relationships between objects.

Therefore, the study and practical application of database models, in particular the Entity-Relationship (ER) model, remains one of the most urgent issues. The ER model allows you to give a mathematical and logical representation of complex business processes in real life. This article analyzes the stages of development of database models, their specific features and the fundamental principles of database design using the ER model. The purpose of the study is to show methods for ensuring data integrity and minimizing logical errors during the design process

Transferring the ER model to the Relational model. The article aims to provide rules for transferring the project from a drawing to a table. Each Entity becomes a Table. Each Attribute becomes a Column in the table. Connections are made through "Foreign Keys".

Attribute Types In the ER model, attributes are not only simple: Simple attribute An indivisible value (for example, Age) Complex attribute: Divided into several parts (for example, Address: street, house, city). Multi-valued attribute: Can have several values (for example, Phone numbers) Derived attribute: Derived from other attributes (for example, Age calculated from the year of birth). The importance of data models

A data model is a set of rules that define the structure of data, the operations performed on them, and integrity constraints. The relational model is currently the most common, it organizes data in the form of tables based on the theory of mathematical sets. This provides the user with convenience and high speed in working with data. Evolution of data models. Database models have become more complex and improved over time.

This can be shown step by step in the article. Hierarchical model (1960s): Data in a tree-like structure, widely used in IBM's IMS system. Network model (1970s): Developed by CODASYL, it solved the limitations of the hierarchical model (there cannot be more than one "parent" node). Relational model

(after 1970): Proposed by E.F. Codd. The relationship between data is built on the basis of values, which makes the system flexible.

Post-relational and NoSQL models: Currently, document, key-value and graph models are used in large-scale systems. Components of the ER model (Enhanced analysis). The ER model should be explained not just as a diagram, but as a semantic model: Strong and weak entities: A strong entity has its own primary key. A weak entity depends on another entity (for example, "Employee" is a strong, "Employee's children" is a weak entity, because without an employee, information about his children does not make sense in the database).

Cardinality: This concept indicates how many times one entity is associated with another entity. (For example, 1:1, 1:N, M:N).

Data Integrity The main task of database models is not only to store, but also to ensure the correctness of data: Object Integrity: Each row must have a Primary Key to be unique. Relational Integrity: Data in tables linked by Foreign Keys must match each other.

ER-model design stages The article can describe the practical process as follows: Requirements Analysis: Determine what objects are in the system. Conceptual Design: Draw an ER-diagram (define entities and relationships). Logical Design ER-diagram is a relational conversion into tables (normalization process). Physical design: It consists of selecting data types and indexes for a specific DBMS (for example, PostgreSQL or SQL Server).

Thus, database models form the intellectual core of information systems. The ER model allows you to visualize complex business processes in a simple and understandable way. Using an ER model at the system design stage not only saves time, but also creates a solid foundation for future system expansion and database optimization.

"The correct choice of model and the use of ER diagrams when designing a database are not just a technical necessity, but also a guarantee of the stability of the entire system. Studies show that correcting errors made at the design stage is ten times cheaper than correcting them after the system is launched.

The entity-relationship model serves as the most reliable bridge that translates complex business processes in the real world into the form of logical tables. This, in turn, allows you to reduce data redundancy (duplication) and increase the speed of the database.

ER modeling methods have proven their effectiveness for many years. Although NoSQL and graph databases are becoming increasingly popular today, the relational approach still remains the leader in working with systematic and structured data.

The relationships between entities By properly setting up and clearly defining attributes, we not only store data, but also have the opportunity to obtain new information and knowledge through their interrelationships. In the future, as the volume of data increases, the role of such logical models will undoubtedly increase even more.

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