

DATA MODELS

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Data Models

A model is a representation of reality, 'real world' objects and events, and their associations. It is an abstraction that concentrates on the essential, inherent aspects of an organization.

Data Model can be defined as an integrated collection of concepts for describing and manipulating data, relationships between data , and constraints on the data in an organization.

Categories of Data Models

The purpose of a data model is to represent data and to make the data understandable. There have been many data models proposed in the literature. They fall into three broad categories:

- Object Based Data Models
- Physical Data Models
- Record Based Data Models

The object based and record based data models are used to describe data at the conceptual and external levels, the physical data model is used to describe data at the internal level.

Object Based Data Models

Object based data models use concepts such as entities, attributes, and relationships. An entity is a distinct object (a person, place, concept, event) in the organization that is to be represented in the database. An attribute is a property that describes some aspect of the object that we wish to record, and a relationship is an association between entities.

Some of the more common types of object based data model are:

- Entity-Relationship
- Object Oriented

The Entity-Relationship model has emerged as one of the main techniques for modelling database design and forms the basis for the database design methodology. The object oriented data model extends the definition of an entity to include, not only the attributes that describe the state of the object but also the actions that are associated with the object, that is, its behavior.

Physical Data Models

Physical data models describe how data is stored in the computer , representing information such as record structures, record ordering, and access paths. There are not as many physical data models as logical data models, the most common one being the Unifying Model.

Record Based Logical Models

Record based logical models are used in describing data at the logical and view levels. In contrast to object based data models, they are used to specify the overall logical structure of the database and to provide a higher-level description of the implementation. The three most widely accepted record based data models are:

- ☐ Hierarchical Model
- ☐ Network Model
- ☐ Relational Model

Hierarchical Model

Hierarchical Database model is one of the oldest database models. This model is like a structure of a tree with the records forming the nodes and fields forming the branches of the tree.

Operations on Hierarchical Model

- Insert Operation
- Update Operation
- Delete Operation

Network Model

The Network model replaces the hierarchical tree with a graph thus allowing more general connections among the nodes. The main difference of the network model from the hierarchical model, is its ability to handle many to many (N:N) relations .

In other words, it allows a record to have more than one parent. Suppose an employee works for two departments. The strict hierarchical arrangement is not possible here and the tree becomes a more generalized graph - a network . The network model was evolved to specifically handle non-hierarchical relationships. A network structure thus allows 1:1 (one : one), 1:M (one : many), M:M (many : many) relationships among entities .

In network database terminology, a relationship is a set. Each set is made up of at least two types of records: an owner record (equivalent to parent in the hierarchical model) and a member record (similar to the child record in the hierarchical model).

Relational Model

Relational model stores data in the form of tables. The relational model consists of three major components:

1. The set of relations and set of domains that defines the way data can be represented (data structure).
2. Integrity rules that define the procedure to protect the data (data integrity).
3. The operations that can be performed on data (data manipulation).

A relational model database is defined as a database that allows you to group its data items into one or more independent tables that can be related to one another by using fields common to each related table.

Comparison of Data Models

Hierarchical Data Model	Network Data Model	Relational Data Model
<p>In this model, to store data hierarchy method is used. It is the oldest method and not in use today.</p>	<p>It organizes records to one another through links or pointers.</p>	<p>It organizes records in the form of table and relationship between tables are set using common fields.</p>
<p>To organize records, it uses tree structure.</p>	<p>It organizes records in the form of directed graphs.</p>	<p>It organizes records in the form of tables.</p>
<p>It implements 1:1 and 1:n relations.</p>	<p>In addition to 1:1 and 1:n it also implements many to many relationships.</p>	<p>In addition to 1:1 and 1:n it also implements many to many relationships.</p>

Hierarchical Data Model	Network Data Model	Relational Data Model
Insertion anomaly exists in this model i.e. child node cannot be inserted without the parent node.	There is no insertion anomaly.	There is no insertion anomaly.
Deletion anomaly exists in this model i.e. it is difficult to delete the parent node.	There is no deletion anomaly.	There is no deletion anomaly.
This model lacks data independence.	There is partial data independence in this model.	This model provides data independence.
It is used to access the data which is complex and asymmetric.	It is used to access the data which is complex and symmetric.	It is used to access the data which is complex and symmetric.
&XML and XAML use this model.	VAX-DBMS, DMS-1100 of UNIVAC and SUPRADBMS's use this model.	It is mostly used in real world applications. Oracle, SQL.

Which Data Model to Use ?

a model that best suits an organization depends on the following factors:

- The organization's primary goals and requirements.
- The volume of daily transactions that will be done.
- The estimated number of enquiries that will be made by the organization.

Among the traditional data models, the widely preferred one is the relational data model. This is because relational model can be used for representing most of the real world objects and the relationships among them. Security and integrity are maintained easily by relational data model. Also, use of relational model for database design increases the productivity of application programs, since it eliminates the need to change the application programs when a change is made to the database. Moreover , relational tables show only the logical relationship. End users need not know the exact physical structure of a table or relation.

Network Model is also free from anomalies but due to its complex nature it is not a preferred model. Since, hierarchical model suffers from lot of anomalies it is useful only for those cases which are hierarchical in nature.

Thank you