**Introduction of ER Model**

* The entity relational model is a model for identifying entities to be represented in the database and representation of how those entities are related.
* The ER data model specifies enterprise schema that represents the overall logical structure of a database graphically.
* The entity relationship diagram explains the relationship among the entities present in the database.
* ER models are used to model real-world objects like a person, a car, or a company and the relation between these real-world objects.
* In short, ER Diagram is the structural format of the database.

**Why Use ER Diagram In DBMS?**

* ER diagrams are used to represent the ER model in a database, which makes them easy to be converted into relations (tables).
* ER diagrams provide the purpose of real-world modeling of objects which makes them intently useful.
* ER diagrams require no technical knowledge and no hardware support.
* These diagrams are very easy to understand and easy to create even for a naïve user.
* It gives a standard solution for visualizing the data logically.

**Components of ER Diagram**

* ER Model consists of Entities, Attributes, and Relationships in a Database System.

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# **Entity**

* An entity is a real-world object, concept, or thing that can be uniquely identified and distinguished
* In the ER model, entities are typically represented as rectangles.
* Entities have attributes that describe their characteristics or properties.
* **Example:**
* **Entity:** "Student"
* **Attributes:** "StudentID" (unique identifier), "FirstName," "LastName," "DateOfBirth"

1. **Strong Entity**

* A Strong Entity is a type of entity that has a key Attribute.
* Strong Entity does not depend on other Entity in the Schema.
* It has a primary key, that helps in identifying it uniquely, and it is represented by a rectangle.
* These are called Strong Entity Types.

1. **Weak Entity**

* An entity that depends on another entity called a weak entity.
* The weak entity doesn't contain any key attribute of its own.
* The weak entity is represented by a double rectangle.
* These are called Weak Entity types.

# **Attribute**

* Attributes are the properties that define the entity type.
* They provide information about the entity.
* **Example:**
* **Entity:** "Student"
* **Attributes:** "StudentID" (unique identifier), "FirstName," "LastName," "DateOfBirth"
* In ER diagram, the attribute is represented by an oval.

1. **Key Attribute**

* The attribute which uniquely identifies each entity in the entity set is called the key attribute.
* For example, Roll No will be unique for each student.
* In ER diagram, the key attribute is represented by an oval with underlying lines.

1. **Composite Attribute**

* An attribute composed of many other attributes is called a composite attribute.
* For example, the Address attribute of the student Entity type consists of Street, City, State, and Country.
* In ER diagram, the composite attribute is represented by an oval comprising of ovals.

1. **Multivalued Attributes**

* An attribute consisting of more than one value for a given entity.
* For example, Phone No (can be more than one for a given student).
* In ER diagram, a multivalued attribute is represented by a double oval.

1. **Derived Attributes**

* An attribute that can be derived from other attributes of the entity type is known as a derived attribute. e.g.; Age (can be derived from DOB).
* In ER diagram, the derived attribute is represented by a dashed oval.

# **Relationship**

* A relationship is used to describe the relation between entities. Diamond or rhombus is used to represent the relationship. (1-1, 1-Many, Many-Many).
* In the Entity-Relationship (ER) model, a relation refers to the association or connection between entities.

1. **One-to-One (1:1):**

* In a one-to-one relationship, each instance of one entity is related to one and only one instance of another entity, and vice versa.
* This is represented using a straight line connecting the two entities.
* For example, consider two entities, "Person" and "Passport." Each person can have only one passport, and each passport is issued to only one person. This is a one-to-one relationship.

1. **One-to-Many (1:N):**

* In a one-to-many relationship, each instance of one entity can be related to

multiple instances of another entity, but each instance of the second entity is related to only one instance of the first entity.

* This is represented using a straight line from the "one" side to a crow's foot (three lines) on the "many" side.
* For example, consider two entities, "Department" and "Employee." Each department can have multiple employees, but each employee belongs to only one department. This is a one-to-many relationship.

1. **Many-to-Many (N:N):**

* In a many-to-many relationship, each instance of both entities can be related to multiple instances of the other entity.
* This is typically represented with a crow's foot on both ends of the connecting line.
* For example, consider two entities, "Student" and "Course." Each student can enroll in multiple courses, and each course can have multiple students. This is a many-to-many relationship.