DATABASE MODELLING

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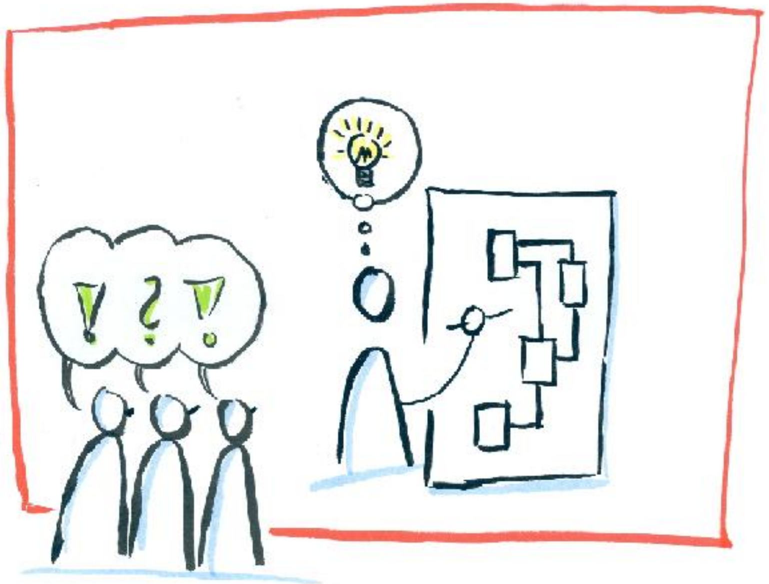
DEFINITION

The process of creating a visual representation of either a whole information system or parts of it to communicate connections between data points and structures

The goal : to illustrate the types of data used and stored within the system, the relationships among these data types, the ways the data can be grouped and organized and its formats and attributes.

Why use Data Model?



Ensures that all data objects required by the database are accurately represented. Omission of data will lead to creation of faulty reports and produce incorrect results.

A data model helps design the database at the conceptual, physical and logical levels.

Data Model structure helps to define the relational tables, primary and foreign keys and stored procedures.

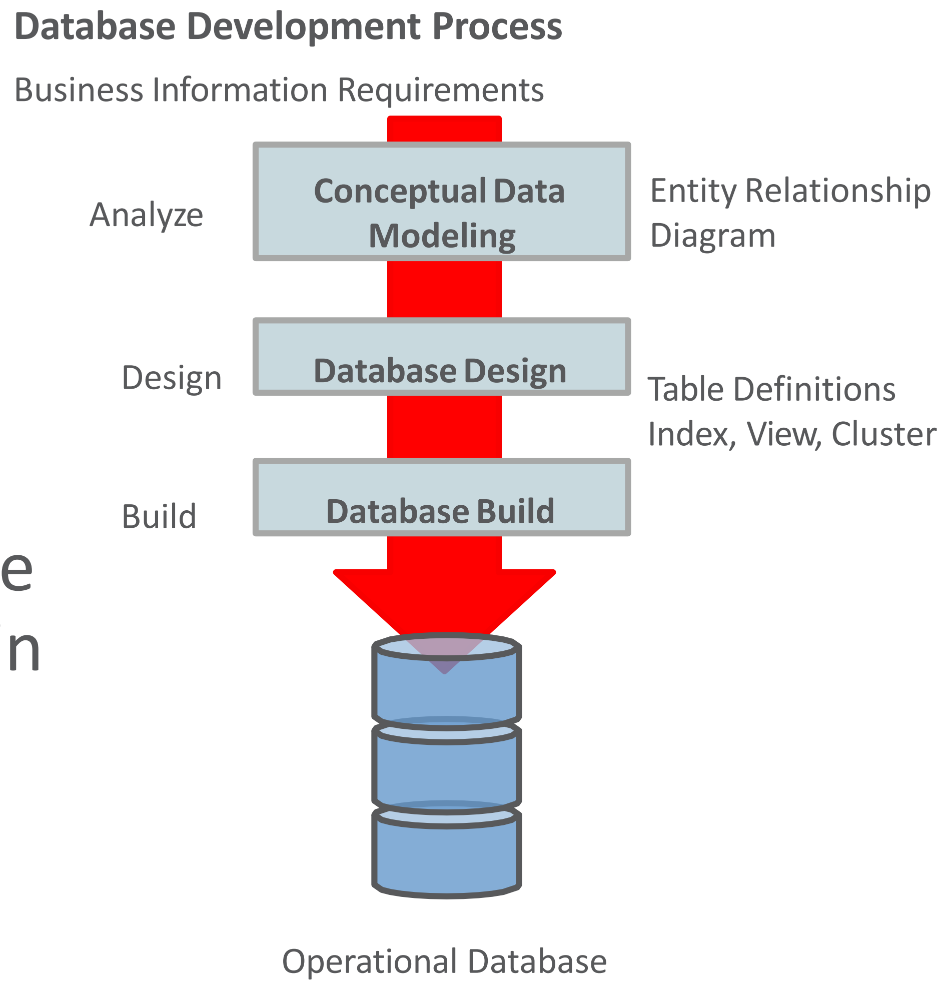
It provides a clear picture of the base data and can be used by database developers to create a physical database.

It is also helpful to identify missing and redundant data.

Though the initial creation of data model is labor and time consuming, in the long run, it makes your IT infrastructure upgrade and maintenance cheaper and faster.

Question: What Does Data Modeling Have to do with a Database?

- Data modeling is the first step in the database development process.
- It involves collecting and analyzing the data that a business needs to track, and then diagramming the organization of that data in an Entity Relationship Diagram.



TYPES OF DATA MODEL

Conceptual data models.

Referred to as domain models and offer a big-picture view of what the system will contain, how it will be organized, and which business rules are involved.

A high-level visualization of the business or analytics processes that a system will support

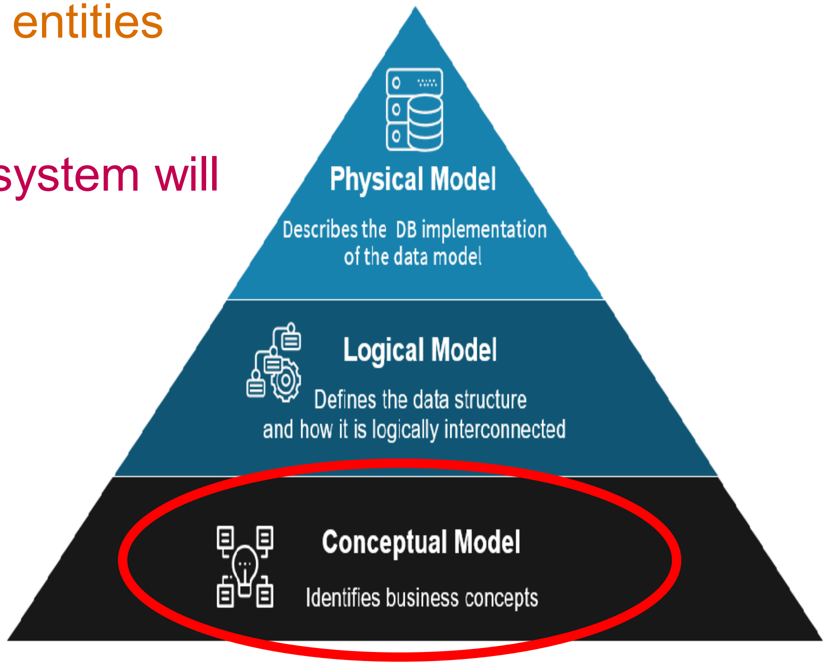
Usually created as part of the process of gathering initial project requirements.

It maps out the kinds of data that are needed, how different business entities interrelate and associated business rules.

Business executives are the main audience, to help them see how a system will work and ensure that it meets business needs

Include entity, their characteristics and constraints, the relationships between them and relevant security and data integrity requirements.

Conceptual models aren't tied to specific database or application technologies.


Physical Model
Describes the DB implementation of the data model
Logical Model
Defines the data structure and how it is logically interconnected
Conceptual Model
Identifies business concepts

What is a Conceptual Model?

A conceptual model:

- Identifies :
  - important entities (objects that become tables in database)
  - relationships among entities
- Does not specify :
  - attributes (objects that become columns or fields in database)
  - unique identifiers (attribute that becomes primary key in database).

Why a Conceptual Model?

A conceptual model is important to a business because it:

- Describes exactly the information needs of the business
- Facilitates discussion
- Prevents mistakes and misunderstandings
- Forms important "ideal system" documentation
- Forms a sound basis for physical database design
- Documents the processes (also known as the "business rules") of the business
- Takes into account regulations and laws governing this industry

Logical data models

Less abstract and provide greater detail about the concepts and relationships in the domain under consideration.

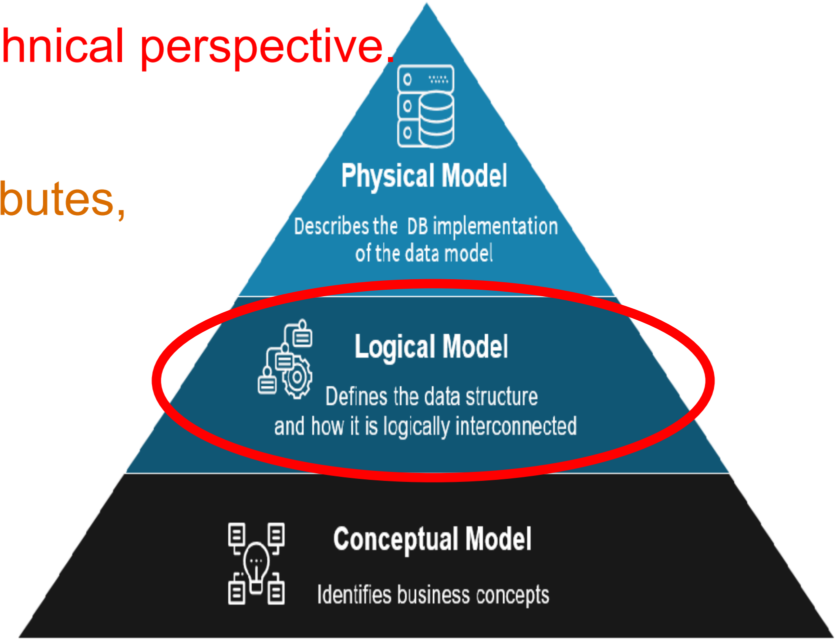
Indicate data attributes, such as data types and their corresponding lengths, and show the relationships among entities.

Show how data entities are related and describe the data from a technical perspective.

For example, they define data structures and provide details on attributes, keys, data types and other characteristics

The technical side of an organization uses logical models to help understand required application and database designs.

But like conceptual models, they aren't connected to a particular technology platform.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What is a Logical Model?

A logical model:

- Includes all entities and relationships among them.
- Is called an entity relationship model (ERM).
- Is illustrated in an ERD.
- Specifies all attributes and UIDs for each entity.
- Determines attribute optionality.
- Determines relationship optionality and cardinality.

Physical data models

They provide a schema for how the data will be physically stored within a database.

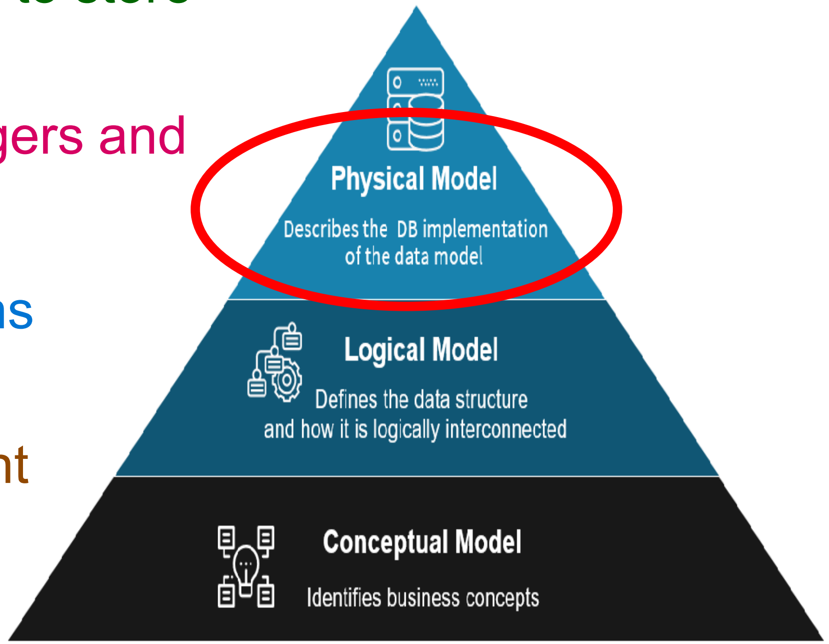
They offer a finalized design that can be implemented as a relational database, including associative tables that illustrate the relationships among entities as well as the primary keys and foreign keys that will be used to maintain those relationships.

Define the structures that the database or a file system will use to store and manage the data.

That includes tables, columns, fields, indexes, constraints, triggers and other DBMS elements.

Database designers use physical data models to create designs and generate schema for databases.

Physical models are specific to the database management system (DBMS) or application software that will be implemented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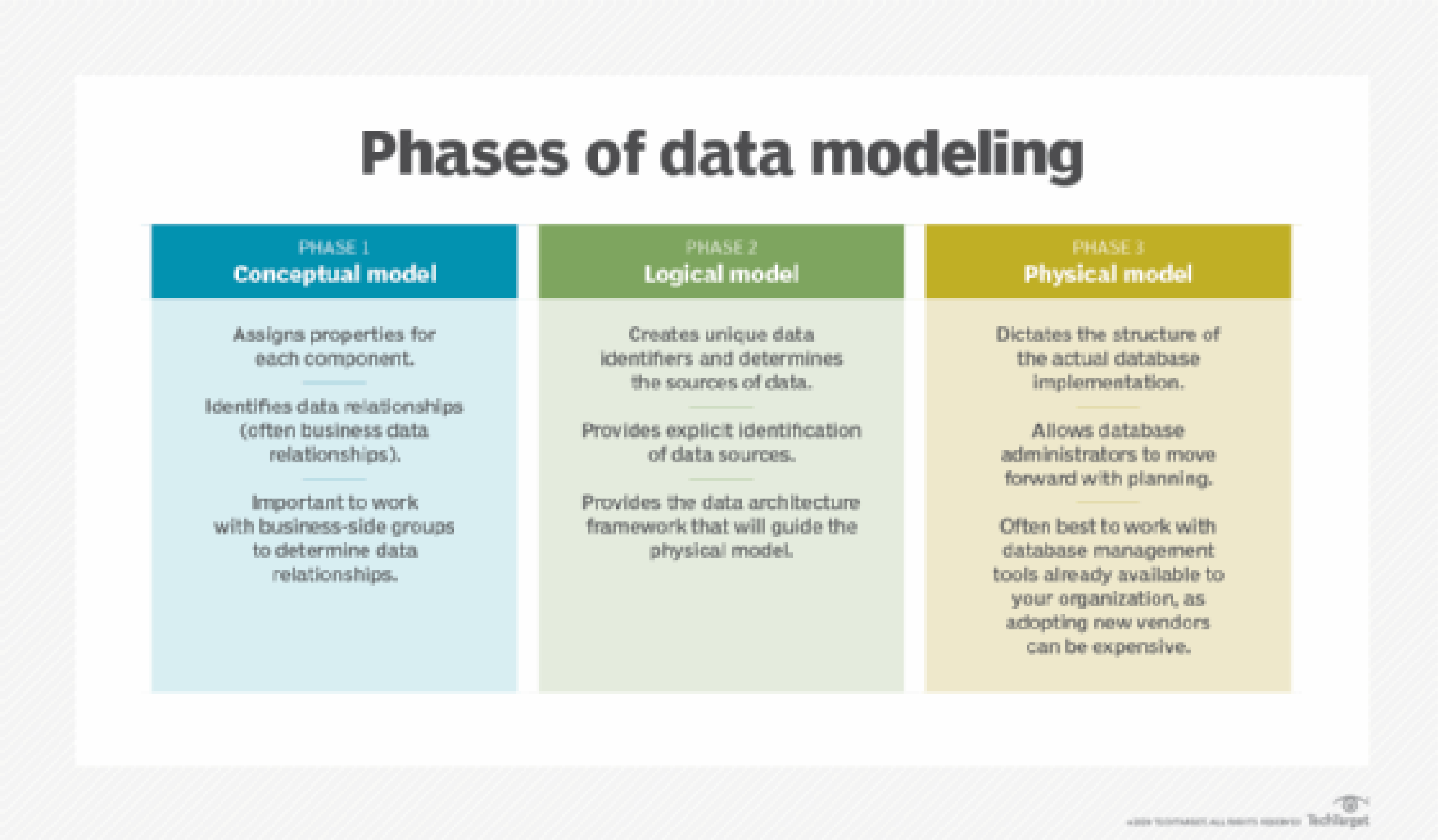
What Is a Physical Model?

A physical model:

- Is an extension to a logical data model.
  - Defines table definitions, data types, and precision.
  - Identifies views, indexes, and other database objects.
- Describes how the objects should be implemented in specific database.
- Shows all table structures, including columns, primary keys, and foreign keys.



Phases of data modeling

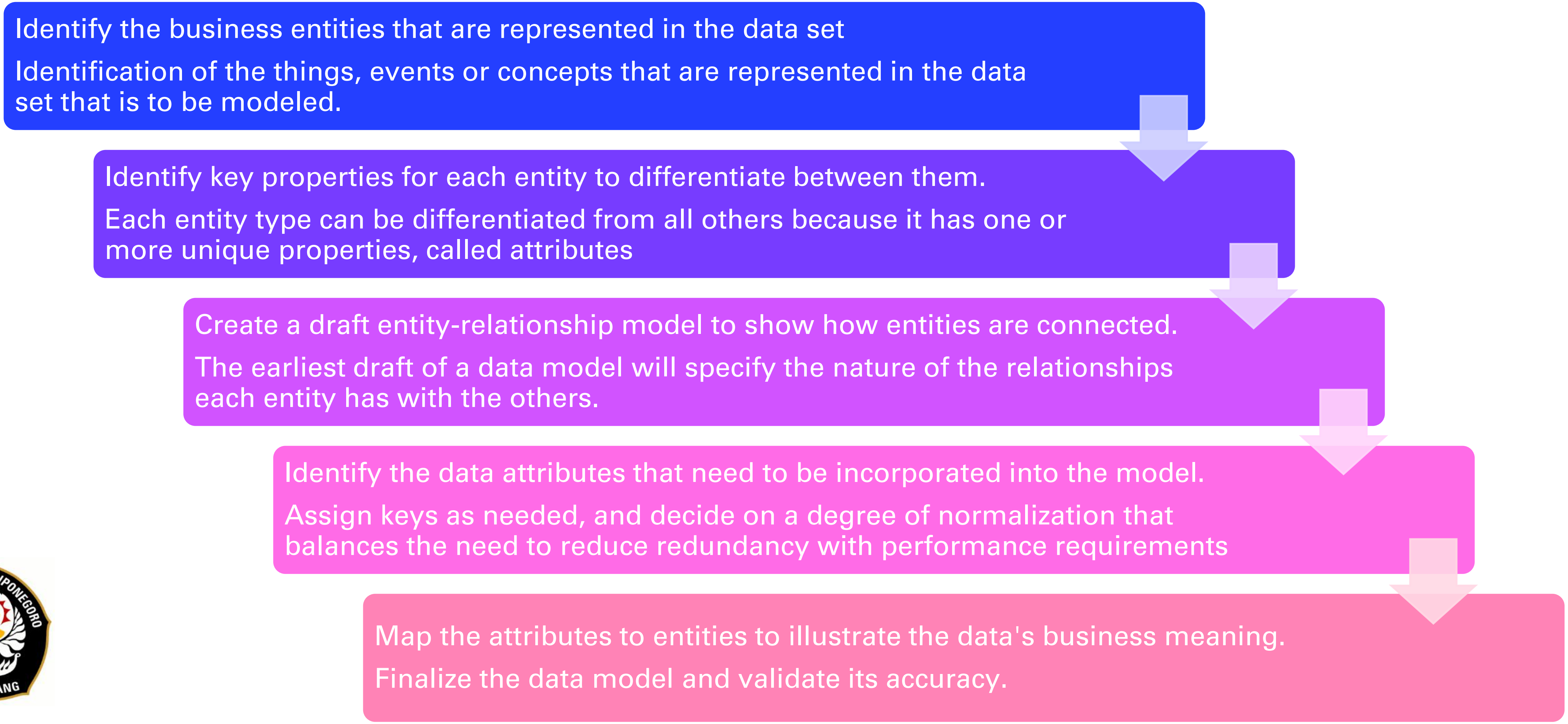
PHASE 1 **Conceptual model**	PHASE 2 **Logical model**	PHASE 3 **Physical model**
Assigns properties for each component. Identifies data relationships (often business data relationships). Important to work with business-side groups to determine data relationships.	Creates unique data identifiers and determines the sources of data. Provides explicit identification of data sources. Provides the data architecture framework that will guide the physical model.	Dictates the structure of the actual database implementation. Allows database administrators to move forward with planning. Often best to work with database management tools already available to your organization, as adopting new vendors can be expensive.

[illegible] TechTarget

Data Modelling - Conclusion

- It is the art of planning, developing, and communicating that allows a group of people to work together to achieve a desired outcome.
- Data modeling is the process of capturing the important concepts and rules that shape a business and depicting them visually on a diagram.
- This diagram becomes the blueprint for designing the physical thing.
- The client’s dream (conceptual model) will become a physical reality (physical model).

Data modeling process



Identify the business entities that are represented in the data set

Identification of the things, events or concepts that are represented in the data set that is to be modeled.

Identify key properties for each entity to differentiate between them.

Each entity type can be differentiated from all others because it has one or more unique properties, called attributes

Create a draft entity-relationship model to show how entities are connected.

The earliest draft of a data model will specify the nature of the relationships each entity has with the others.

Identify the data attributes that need to be incorporated into the model.

Assign keys as needed, and decide on a degree of normalization that balances the need to reduce redundancy with performance requirements

Map the attributes to entities to illustrate the data's business meaning.

Finalize the data model and validate its accuracy.

Database Development Process

- Data modeling begins by researching the information requirements of a business.
- Example: Here is a set of information requirements.
  - I manage the Human Resources Department for a large company. We need to store data about each of our company’s employees. We need to track each employee's first name, last name, job or position, hire date and salary. For each employee on commission, we also need to track his/her potential commission. Each employee is assigned a unique employee number.

Database Development Process

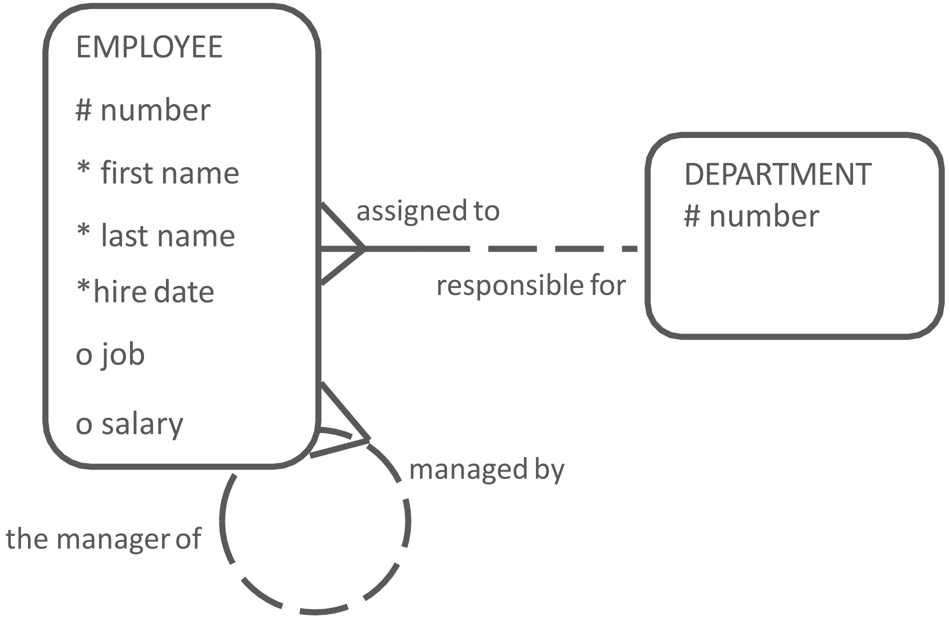
- Example: Here is a set of information requirements.
  - Our company is divided into departments. Each employee is assigned to a department -- for example, accounting, sales, or development. We need to know the department responsible for each employee and the department location. Each department has a unique number.
  - Some of the employees are managers. We need to know each employee's manager and all of the employees that are managed by each manager.

Database Development Process

- An entity relationship diagram should completely capture and accurately model the organization’s information needs and support the functions of the business.

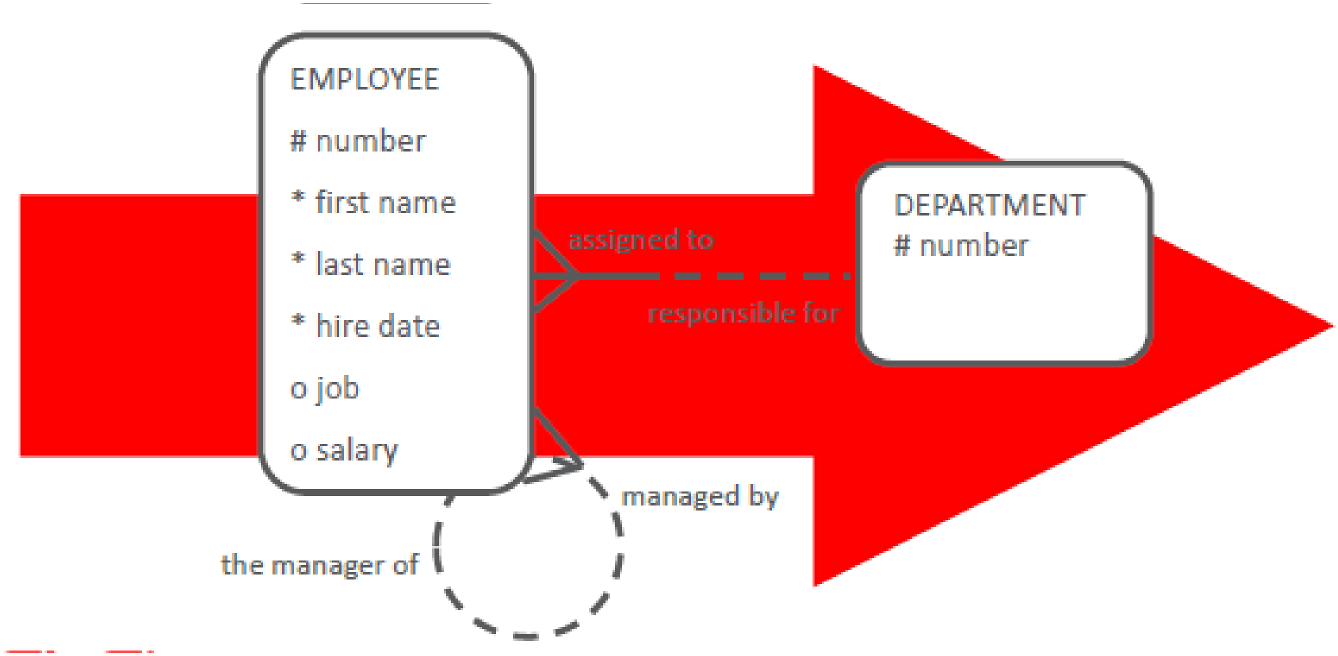
EXAMPLE

The following entity relationship diagram represents the information requirements of the Human Resources Department.



Database Development Process

- Step two, the database design phase of the development process, translates the information modeled on the entity relationship diagram to a table instance chart.



Database Development Process

ERD 1

ERD 2

Database Development Process

The table instance chart lists the design specifications of the information and has the following components:

- Table name
- Column names
- Keys: a primary key (PK) is the unique identifier for each row of data; a foreign key (FK) links data in one table to the data in a second table by referring to the PK column in the second table
- Nulls: indicates if a column must contain a value (mandatory)

Database Development Process

- Unique: indicates if the value contained in a column is unique within the table
- Data type: identifies the definition and format of the data stored in each column

EMPLOYEES

Emp_ID	F_Name	L_Name	Hire_Date	JOb	Salary	Dept_ID

DEPARTMENTS

Dept_ID	Name	Location	Phone_No

Database Development Process

- Structured Query Language (SQL) commands are used to build the physical structure of the database.

DATABASE BUILD—Step Three

```
CREATE TABLE departments
(deptno NUMBER(5) CONSTRAINT depts_deptno_PK PRIMARY KEY,
 name VARCHAR2(25) CONSTRAINT depts_name_NN NOT NULL,
 loc VARCHAR2(30) CONSTRAINT depts_loc_NN NOT NULL);
```

```
CREATE TABLE employees
(empno NUMBER(9) CONSTRAINT emps_empno_PK PRIMARY KEY,
 fname VARCHAR2(15) CONSTRAINT emps_fname_NN NOT NULL,
 lname VARCHAR2(20) CONSTRAINT emps_lname_NN NOT NULL,
 hiredate DATE CONSTRAINT emps_hiredt_NN NOT NULL,
 salary NUMBER(9,2),
 commission NUMBER(9,2),
 mgr NUMBER(9) CONSTRAINT emps_mgr_FK
        REFERENCES employees(empno),
 deptno NUMBER(5) CONSTRAINT emps_deptno_FK
           REFERENCES departments(deptno));
```

Database Development Process

- SQL is also used to populate, access, and manipulate the data within the relational database.

DATABASE BUILD—Step Three

```
INSERT INTO departments
   (deptno,name,loc)
VALUES
   (123,'Accounts','US');
```

```
SELECT fname, lname, deptno
FROM employees
WHERE deptno = 123;
```

```
UPDATE departments
SET name = 'marketing'
WHERE deptno=123
```

Terminology

Key terms used in this lesson included:

- Data type
- Foreign key (FK)
- Nulls
- Primary key (PK)
- Table instance chart
- Unique

The way to get started is to quit talking and begin doing.

Walt Disney

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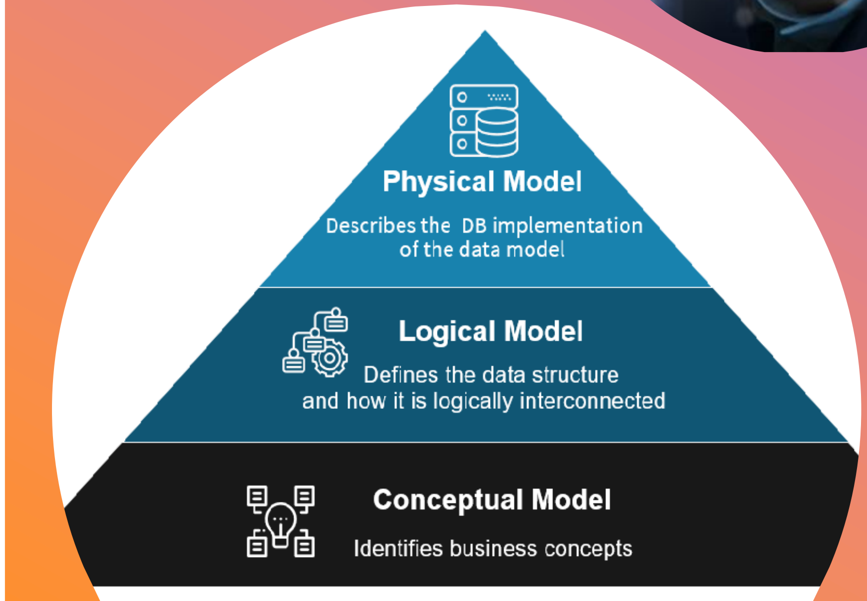
2023



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