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Types of Database Management System

In this tutorial, we are going to learn about the **various types of database management system (DBMS): Hierarchical Databases, Network Databases, Relational Databases, Object-oriented Databases, Graph Databases, ER model Databases, Document Databases.**

Submitted by [Anushree Goswami](#), on June 06, 2019

There is a wide **variety of Databases in Database Management System**. Name of the **different types of databases** is given below.

Types of DBMS

1. Hierarchical Databases
2. Network Databases
3. Relational Databases
4. Object-oriented Databases
5. Graph Databases
6. ER model Databases
7. Document Databases

1) Hierarchical Databases

- a. Hierarchical Database System Structure was developed by IBM in the early 1960s.
- b. In this type of Database, data gets stored in parent-children relationship nodes. Also, the records not only contain the data of it but of their parent and children as well.
- c. As the name suggests, 'Hierarchy', it is a tree-like structure. There are links attached between each record as a parent-children relationship.
- d. Data gets stored in the form of a collection of fields in which each field contains only one value, i.e., every individual record has only one parent and a parent can have one or more than one children.
- e. To retrieve the data, we need to traverse each tree until we get the desired data.

It is simple but inflexible due to the parent-child one-to-many relationship. They are mostly used in Banking and Telecommunications industries to build high performance and manage applications.

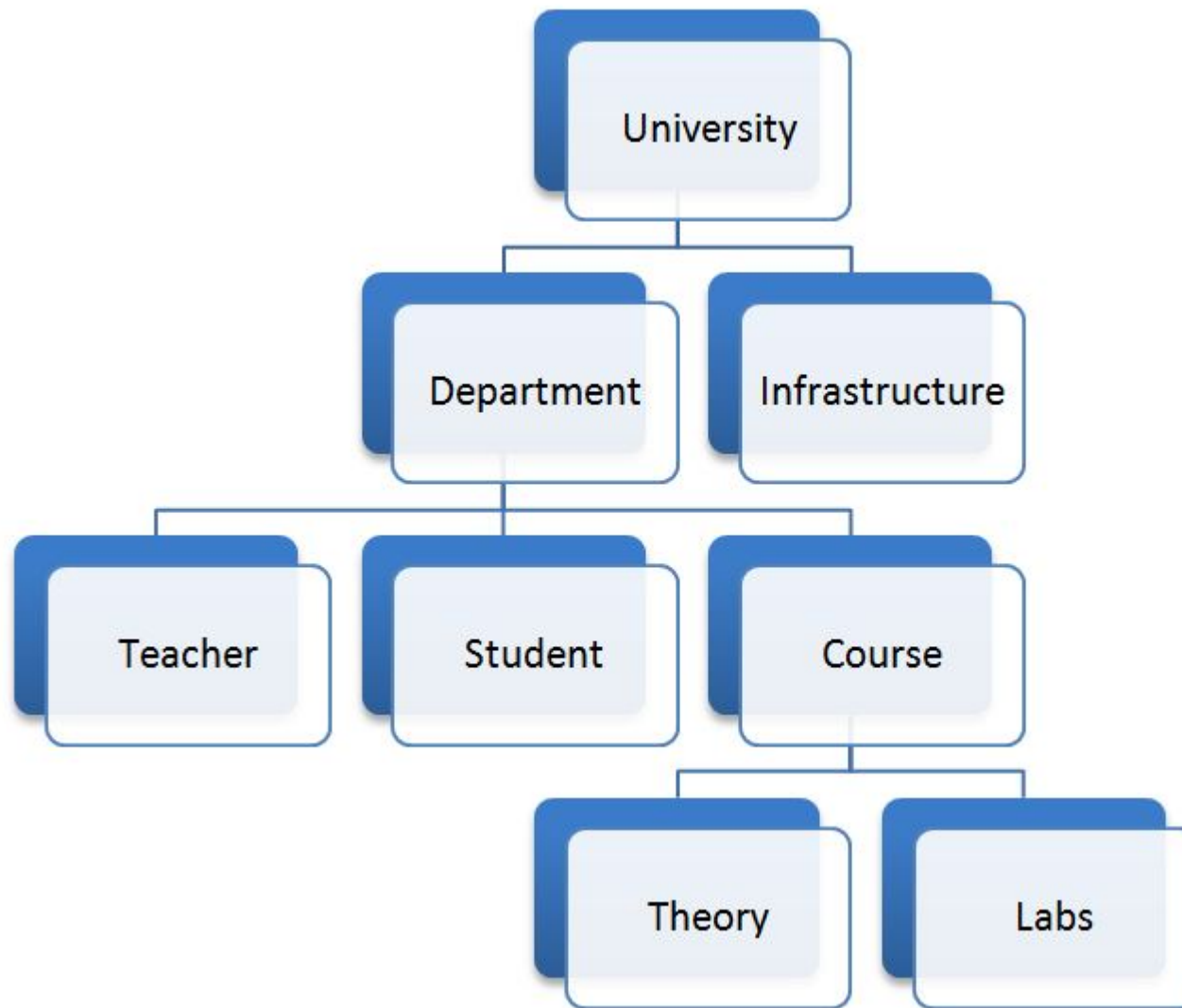
Example: IBM Information Management System (IMS) and Windows Registry.

Advantages of Hierarchical Databases

The hierarchical database has the advantage that it is a two-edged and can be retrieved and manipulated or altered rapidly due to the tree-like structure of the record and also relationships between records are defined in advance.

Disadvantages of Hierarchical Databases

- a. The hierarchical database has the disadvantage that in this type of database structure each node can only have one parent, and children can't have relationships or linkages between them, even if they make sense from a logical standpoint.
- b. In order to add record or data in the database, the whole database needs to be redefined.

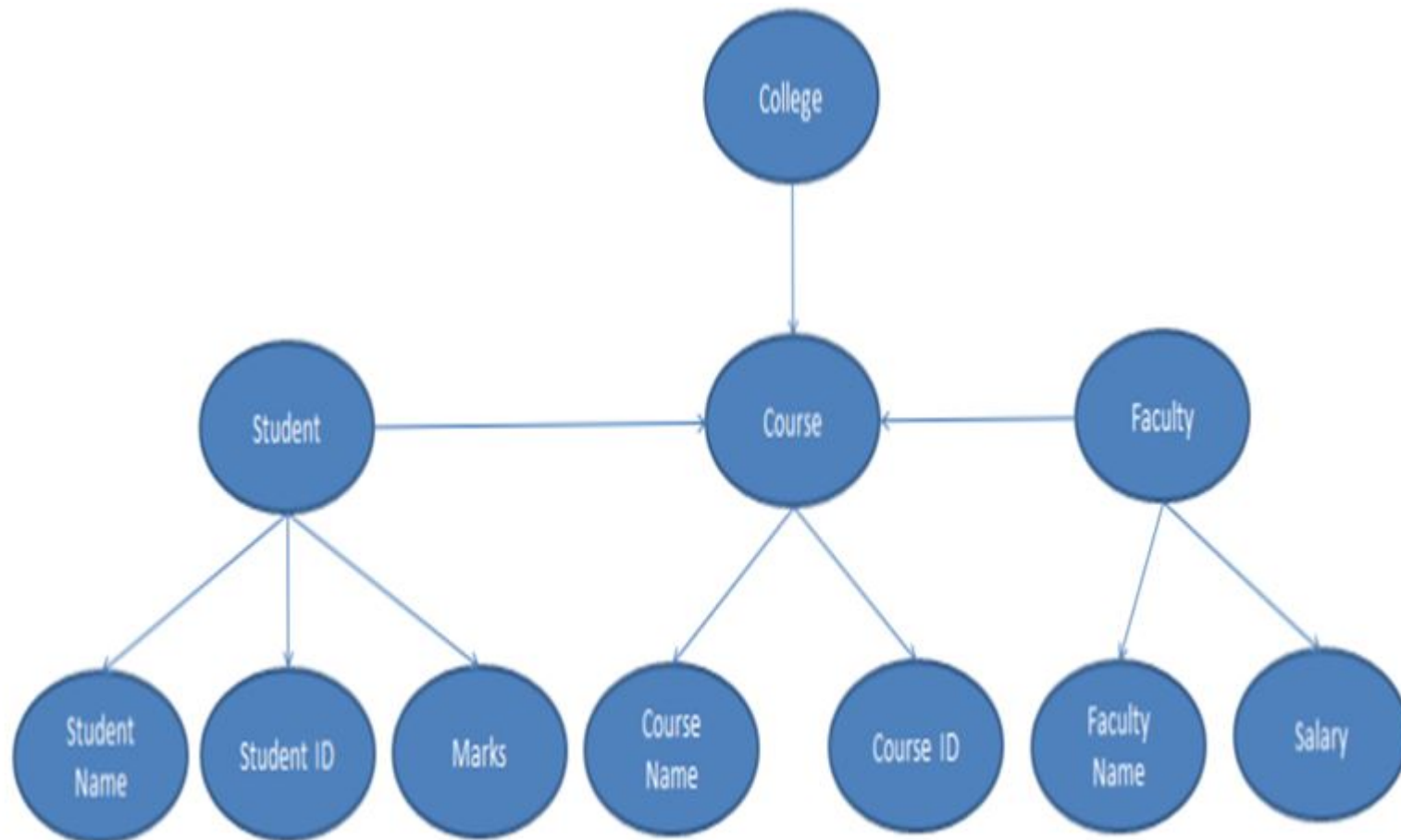


Hierarchal Database Model

2) Network Databases

- a. The network database structure was invented by Charles Bachman. Network database management systems (Network DBMSs) uses network structure to create a relationship between entities.
- b. Network databases are mainly used on a large network of computers.
- c. Network databases are similar to hierarchical databases differs with one key point that in network databases one node can have a relationship with multiple entities.
- d. In network databases, parents are termed as occupier and children are termed as members. Data in the network database is organized as many-to-many relationships.

Example: Integrated Data Store (IDS), IDMS (Integrated Database Management System), Raima Database Manager, TurboIMAGE, and Univac DMS-1100.



Network Database Model

3) Relational Databases

- a. Relational Databases are the most popular among all databases.
- b. In this type of database, there is a relationship between data and that is stored in the form of the table of rows and columns, such that row represents record and column represents the attribute.
- c. Every individual field represents the data value. In order to query the Relational Databases, Structured Query Language (SQL) is used which includes insertion, deletion, manipulation and search the records.

Relational database depicts the relation between two or more tables, but how this relation is made? **Through Key Fields**. Every row has its unique key field and these key fields are used to connect one table to another one.

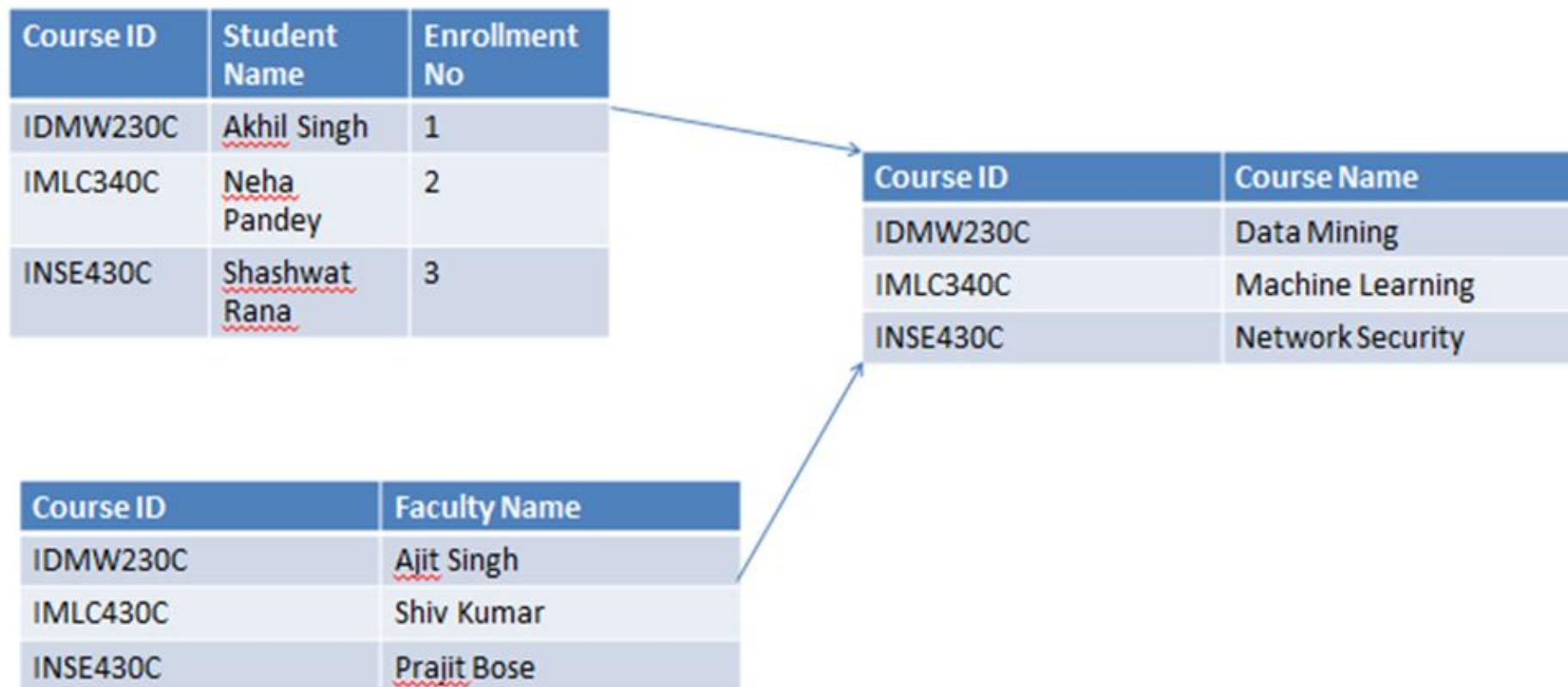
Example: Oracle, SQL Server, MySQL, SQLite, and IBM DB2.

What's so unique and fascinating about the relational database that is not in other databases? There are mainly two reasons:

- a. These databases can be used with little or no training
- b. One can easily modify database entries without specifying the entire

Properties of Relational Tables

1. It's values are Atomic.
2. Every row is individual.
3. Columns are undistinguished.
4. Sequence of Rows is Insignificant.



Relational Database Model

4) Object-Oriented Databases

- Object-oriented Databases were created in the early 1980s.
- Object-Oriented Databases deals with the functionality of the object-oriented programming and it increases the semantics of the C++ and Java.
- Advance programming language objects are required in Object-Oriented Databases.
- It provides full-featured database programming capability while containing native language compatibility such that it alters the database functionality to object programming languages.

- e. Applications in Object-Oriented databases require less code, use more natural data modeling, and code bases are easier to maintain.
- f. Object developers can write complete database applications with a less amount of effort and in less time.
- g. Object-oriented databases use small software called objects. The objects themselves are stored in the object-oriented database.
- h. Every object in Object-Oriented databases contains two elements:
 - i. Piece of data (e.g., sound, video, text, or graphics)
 - ii. Instructions or software programs called methods

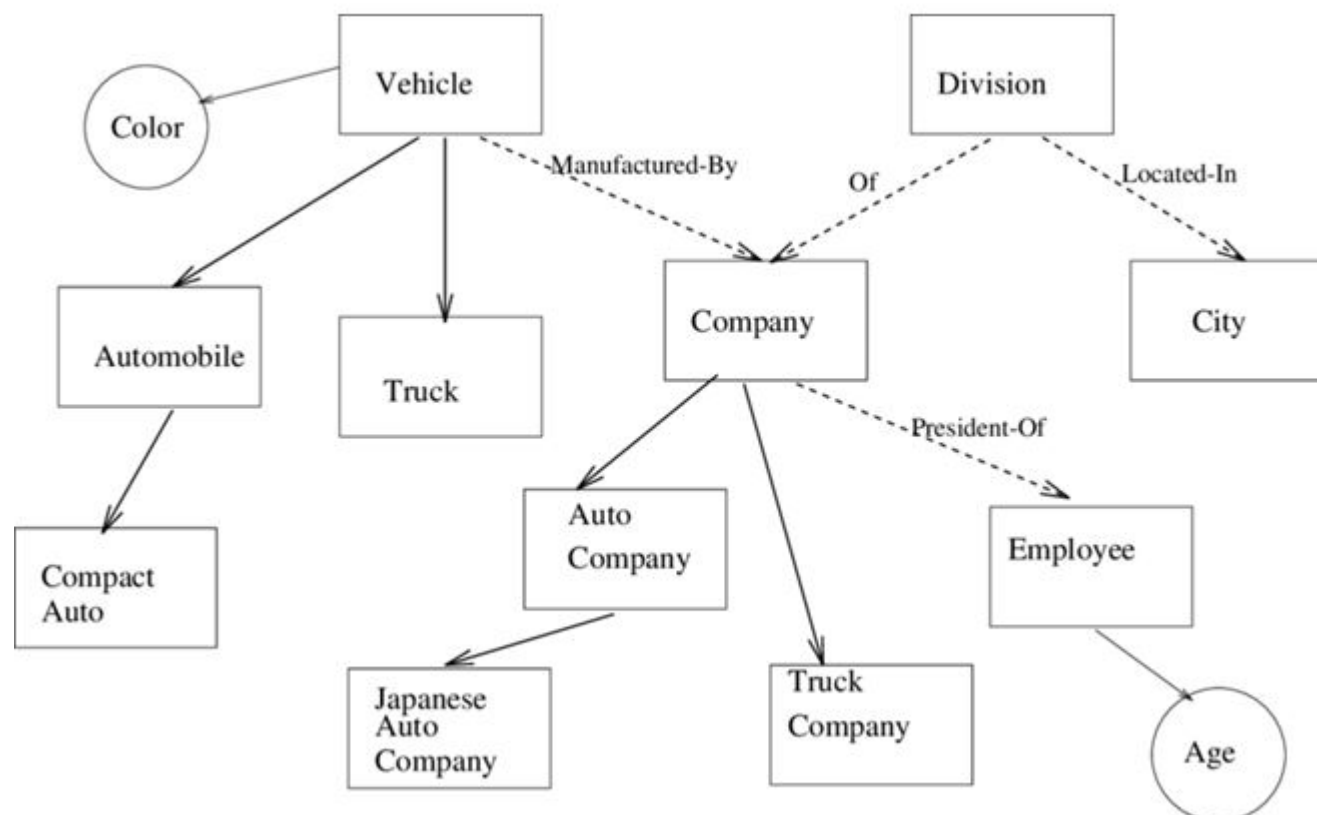
Example: Some Object-Oriented Databases were designed to work with OOP languages such as Delphi, Ruby, C++, Java, and Python. Some popular Object-Oriented Databases are TORNADO, Gemstone, InterSystems Cache, Versant Object Database, ODABA, ZODB, Poet. JADE, and Informix.

Advantage of Object-oriented databases

One of the most important advantages of Object-Oriented Database is its ability to mix and match reusable objects. It provides the unbelievable multimedia capability.

Disadvantages of Object-oriented Databases

1. They are more expensive to develop.
2. Most organizations don't want to abandon their traditional database approach and convert into this database system.



Object-oriented databases Model

Image source: https://www.researchgate.net/profile/Ehud_Gudes2/publication/3626590/figure/fig1/AS:669008118415369@1536515373317/A-Object-Oriented-Database-Schema.png

5) Graph Databases

- Graph databases are NoSQL databases and it uses the graphical structure for semantic queries.
- Data is stored in the form of nodes, edges, and properties in which node is equivalent to a record, the edge is a link between two nodes and properties are additional information added into the nodes.

Example: Neo4j, Azure Cosmos DB, SAP HANA, Sparksee, Oracle Spatial and Graph, OrientDB, ArrangoDB and MarkLogic.

Graph database are supported by some RDBMs, including Oracle and SQL Server 2017 and later versions.



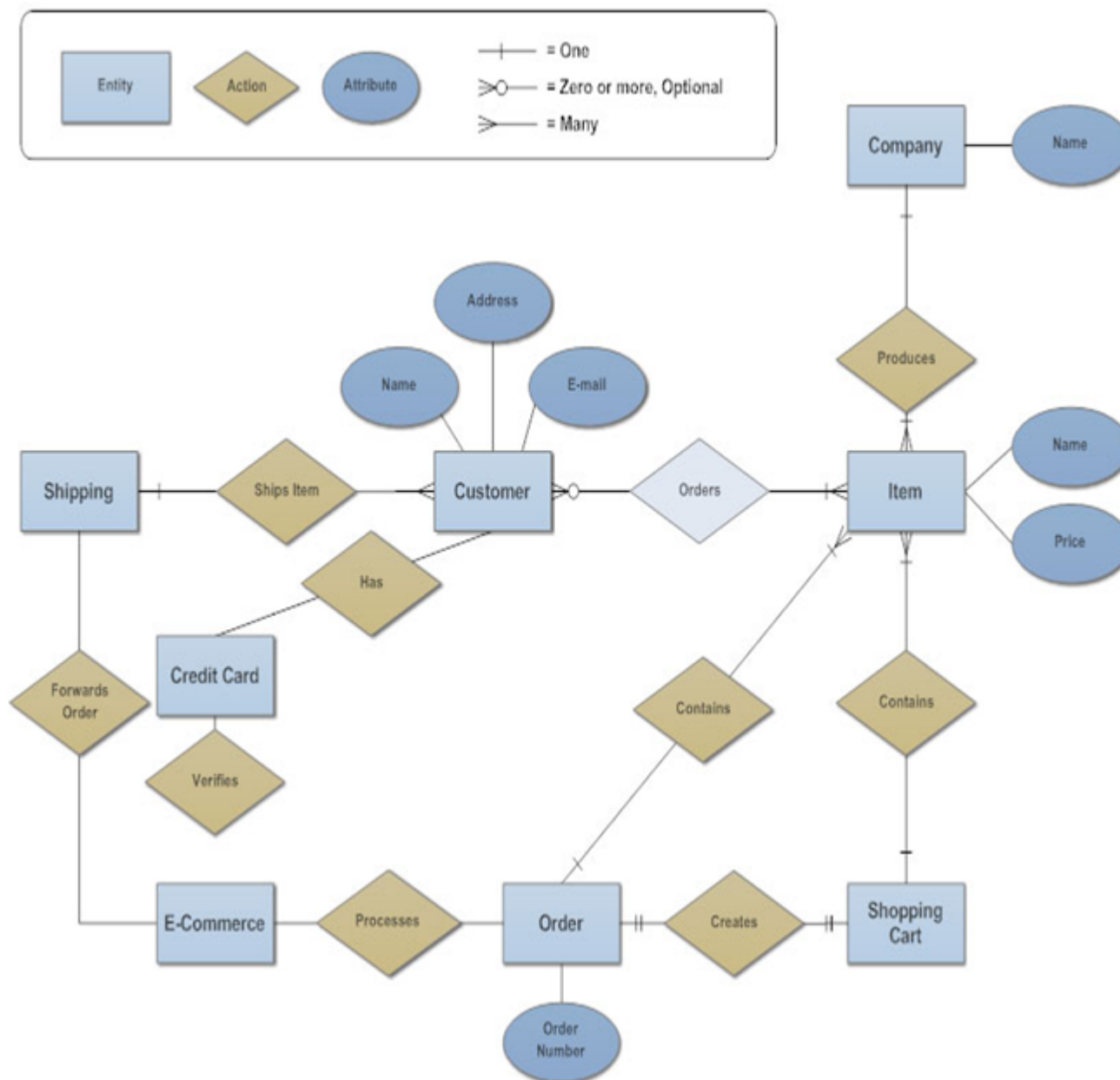
Graph database Model

Image source: https://database.guide/wp-content/uploads/2016/06/graph_database_relationship_example.png

6) ER Model Databases

- a. Entity-Relations Model Database was developed by Peter Chen 1976.
- b. Here, the ER model is applied as a database. Each row in the table represents one instance of an object type, and each column in a table represents an attribute type.

Entity Relationship Diagram - Internet Sales Model



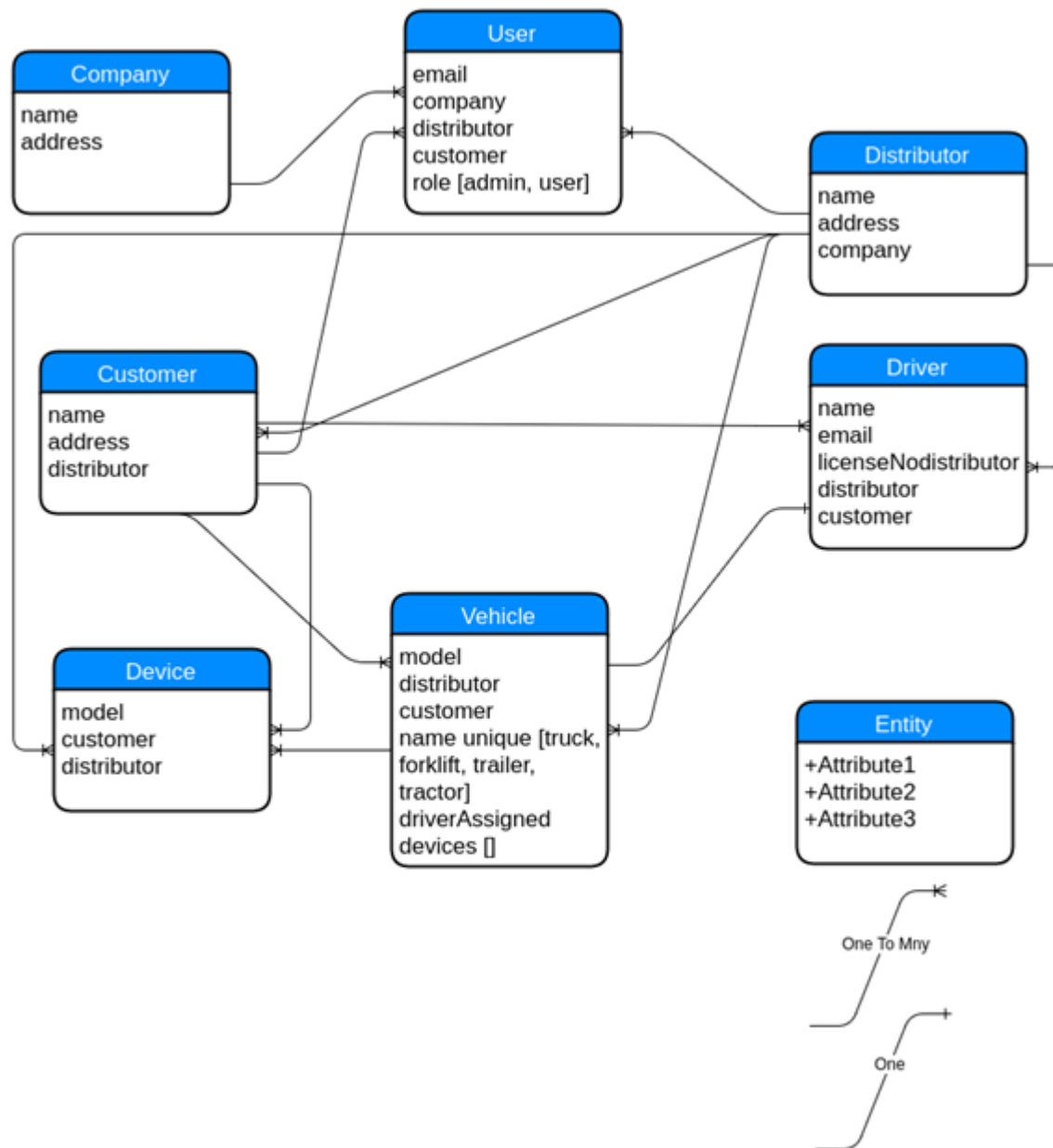
ER Model Databases Model

Image source: <https://wcs.smartdraw.com/entity-relationship-diagram/img/erd.jpg?bn=1510011144>

7) Document Databases

- a. Document databases (DBs) are also a NoSQL database.
- b. It stores data in the form of documents which are key values. Each document makes the relationship of the data with other data elements and attributes.
- c. It became popular due to its storage of documents and NoSQL properties. The specialty of NoSQL data storage is that it provides a faster mechanism for storing and searching for documents.

Example: Hadoop / Hbase, Hyperable, MapR, , Amazon SimpleDB, Apache Flink, IBM Informix and Azure DocumentDB.



Document Database Model

Image source: <https://www.techhighness.com/images/er.png>



TOP Interview Coding Problems/Challenges

- Run-length encoding (find/print frequency of letters in a string)
- Sort an array of 0's, 1's and 2's in linear time complexity
- Checking Anagrams (check whether two string is anagrams or not)
- Relative sorting algorithm
- Finding subarray with given sum
- Find the level in a binary tree with given sum K
- Check whether a Binary Tree is BST (Binary Search Tree) or not
- 1[0]1 Pattern Count

Capitalize first and last letter of each word in a line
Print vertical sum of a binary tree
Print Boundary Sum of a Binary Tree
Reverse a single linked list
Greedy Strategy to solve major algorithm problems
Job sequencing problem
Root to leaf Path Sum
Exit Point in a Matrix
Find length of loop in a linked list
Toppers of Class
Print All Nodes that don't have Sibling
Transform to Sum Tree
Shortest Source to Destination Path



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