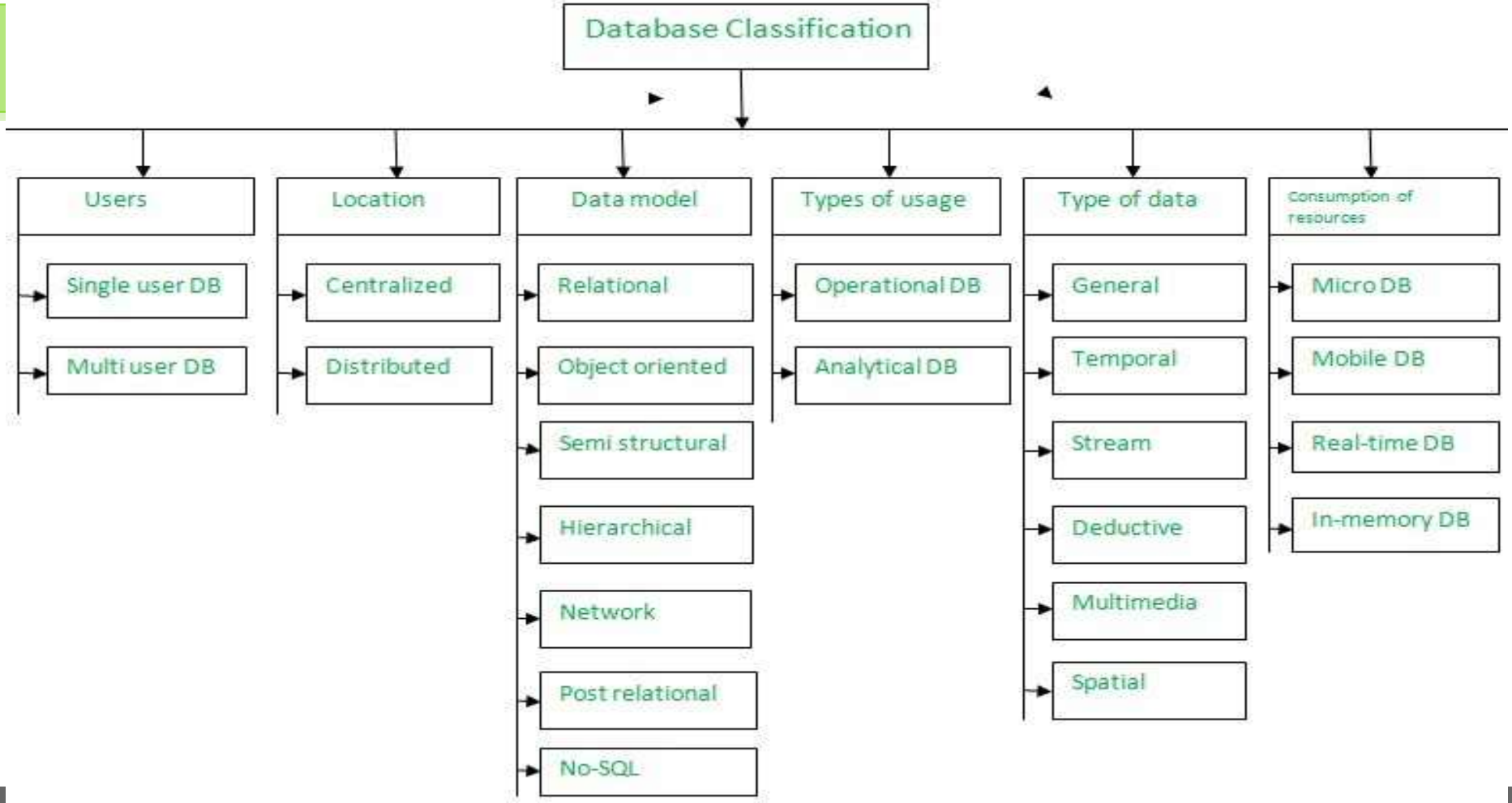
Classification of Database

- Based on Number of Users
- Based on Location
- Based on Data Model
- Based on Usage
- Based on Data
- Based on Resource Consumption


Database Classification
Users
Single user DB
Multi user DB
Location
Centralized
Distributed
Data model
Relational
Object oriented
Semi structural
Hierarchical
Network
Post relational
No-SQL
Types of usage
Operational DB
Analytical DB
Type of data
General
Temporal
Stream
Deductive
Multimedia
Spatial
Consumption of resources
Micro DB
Mobile DB
Real-time DB
In-memory DB

Types of Database

1. **Single – User** = supports only one user at the time
2. **Desktop** = single –user database running on a personal computer
3. **Multi-user** = support multiple users at the same time
4. **Workgroup** = multi-user database that supports a small group of users or (a single department)
5. **Enterprise** = multi-user database that supports a larger group of users or (entire organisation)

Classification as per No. Of Users

A DBMS can be classification based on the number of users it supports. It can be a *single-user database system*, which supports one user at a time, or a *multiuser database system*, which supports multiple users concurrently.

Single – User: It supports only one user at a time. In other words, if user A is using the database, users B and C must wait until user A is done.

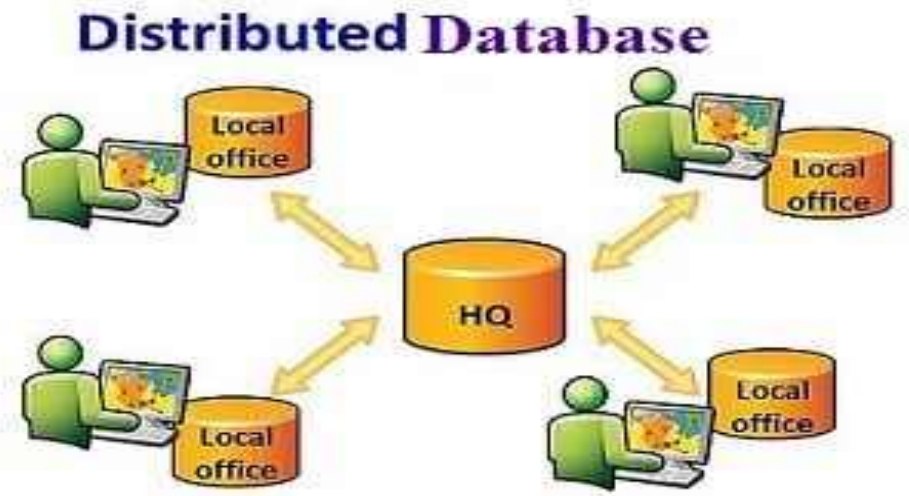
A single-user database that runs on a personal computer is called a desktop database.

Multi – User: It supports multiple users at the same time.

When the multiuser database supports a relatively small number of users (usually fewer than 50) or a specific department within an organization, it is called a **workgroup database**.

When the database is used by the entire organization and supports many users (more than 50, usually hundreds) across many departments, the database is known as an **enterprise database.**

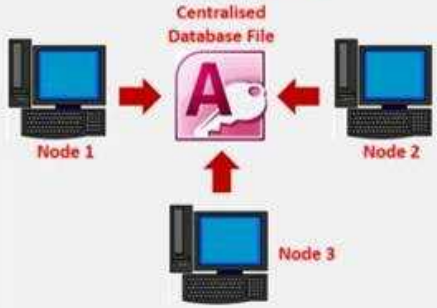
Classification as per Location



Centralised vs. Distributed Databases

Centralised Databases

A **single** database located at **1 site** on a network



Advantages:

Since there is only 1 database file, it is easier to:

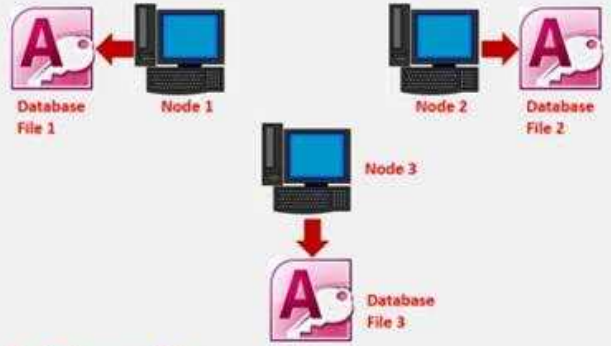
- Get a complete view of Data
- Manage, update an backup Data

Disadvantages:

- Bottle necking from multiple users accessing the same file – slowing down productivity

Distributed Databases

Consists of **2 or more files** located at different sites on a network



Advantages:

Having multiple database files means:

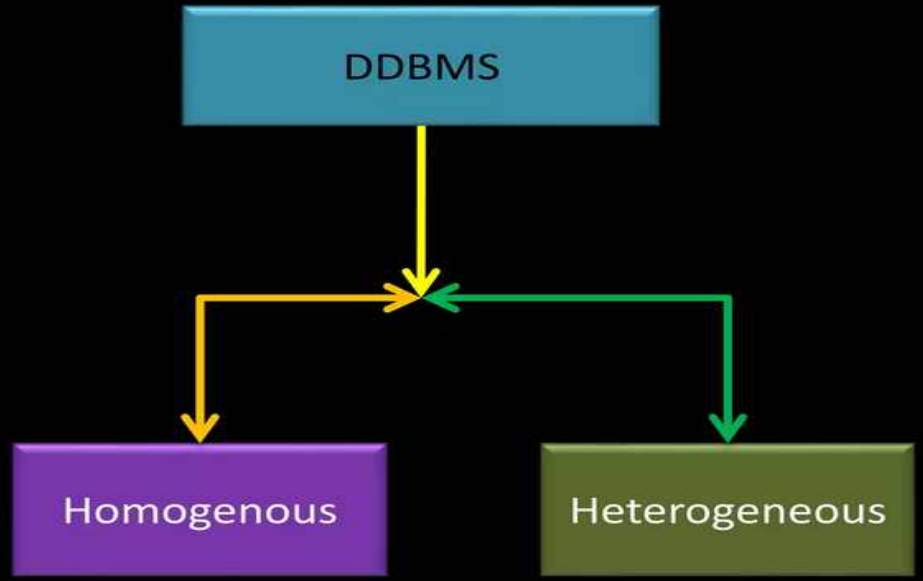
- Users wont interfere with each other when accessing / manipulating Data
- Speed since files are retrieved from nearest location
- If one site fails, the system can still run

Disadvantages:

- Time for Synchronisation of the multiple databases
- Data Replication for each different database file

Types of Distributed Database System

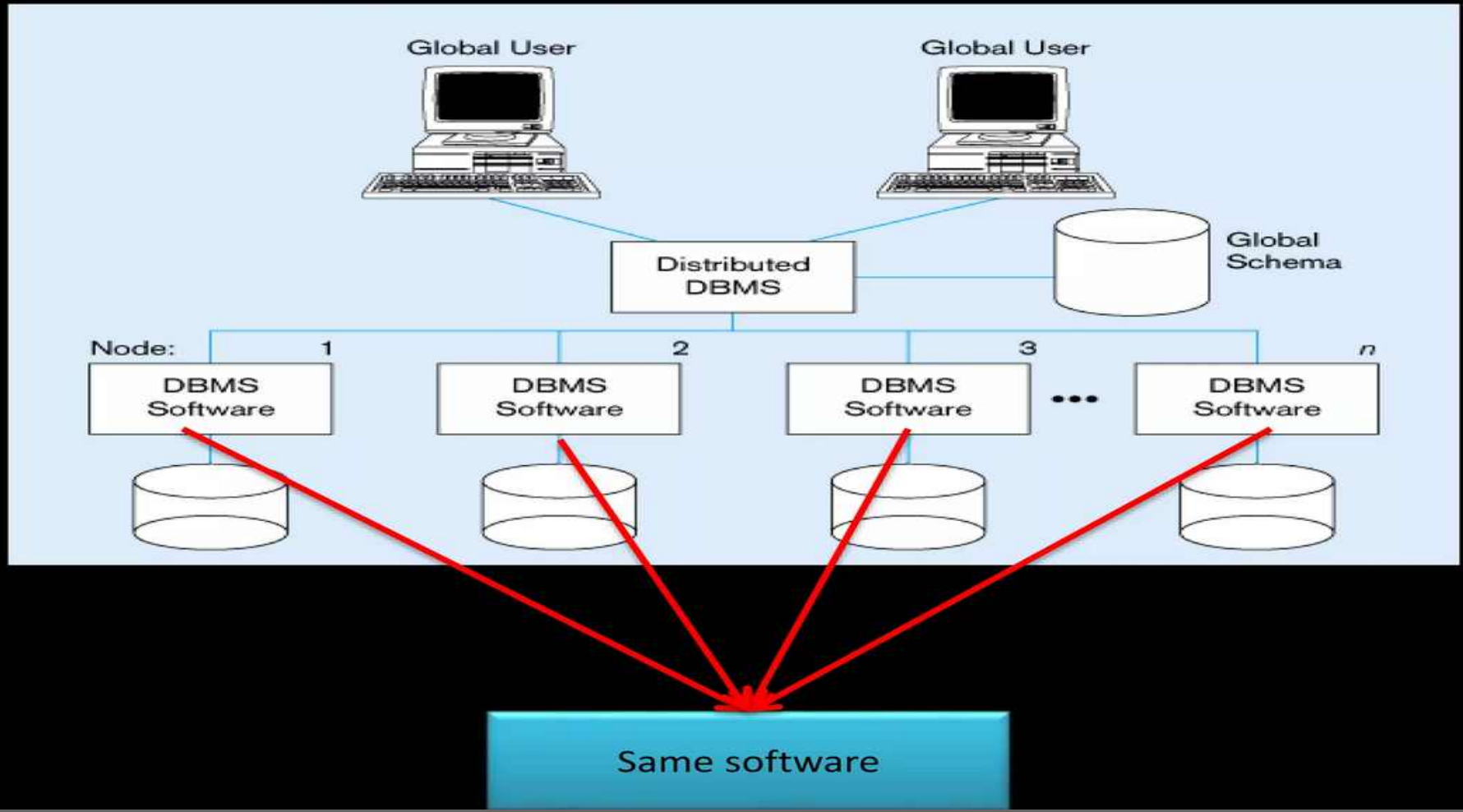
- **Homogeneous**
- **Heterogeneous**



Homogenous Distributed Database Systems

- ✓In this type of database has all data center have same software
- ✓Much easier to design and manage.
- ✓It appears to user as a single system

Homogeneous Database



Advantages of Homogeneous Distributed Database

- ✓ Easy to use
- ✓ Easy to mange
- ✓ Easy to Design

Disadvantages of Homogeneous Distributed Database

- ✓ Difficult for most organizations to force a homogeneous environment

Heterogeneous Distributed Database Systems

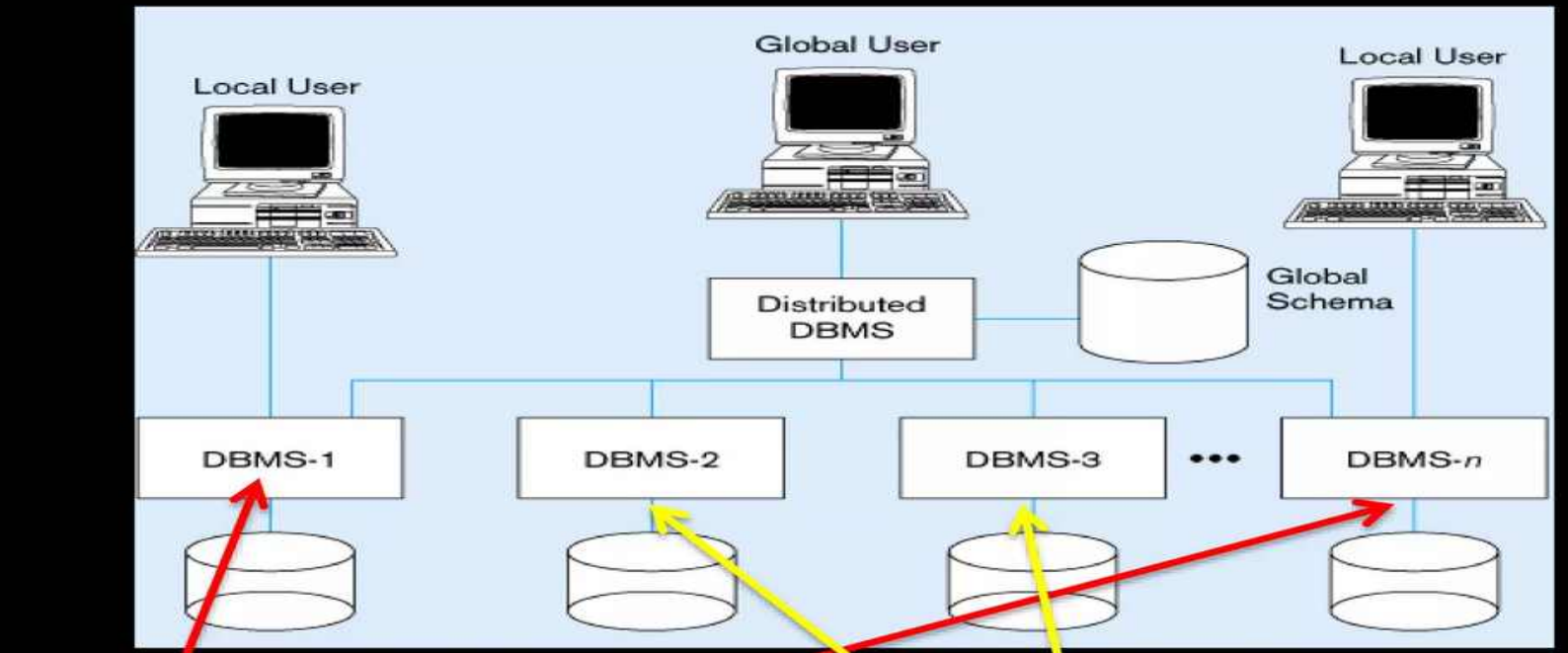
✓In this type of database , Different data center may run different DBMS products, with possibly different underlying data models.

✓Occurs when sites have implemented their own databases and integration is considered later.

✓Translations required to allow for:

- Different hardware.
- Different DBMS products.
- Different hardware and different DBMS products.

Heterogeneous Distributed database



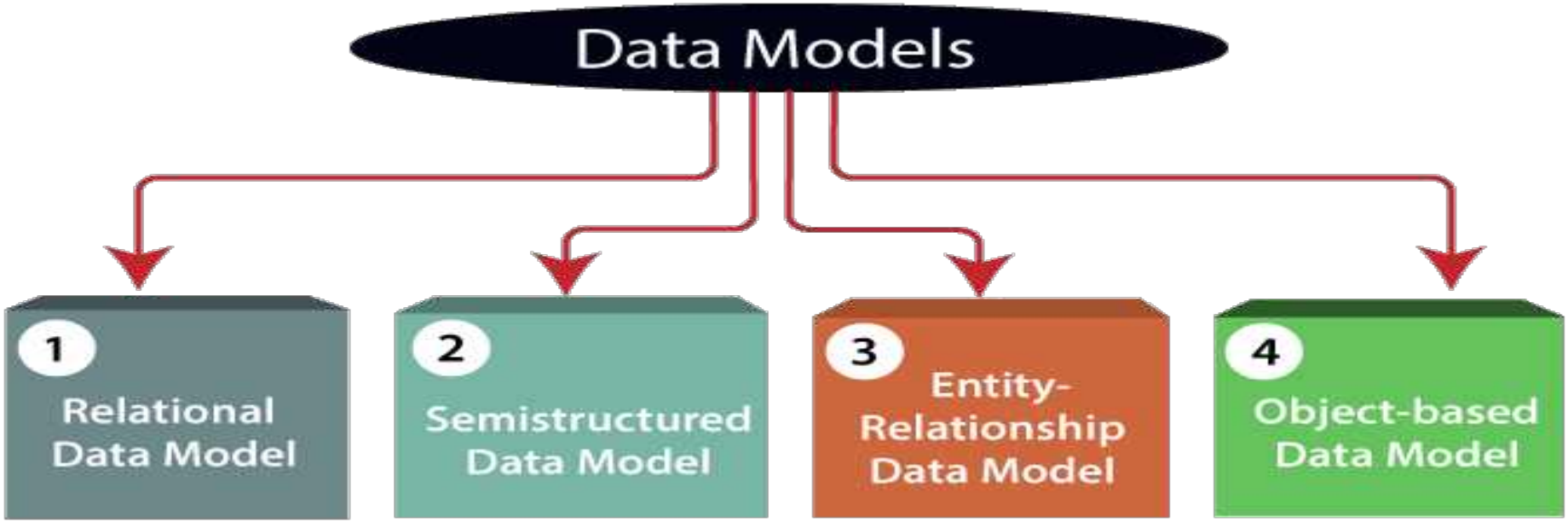
Advantages of Heterogeneous Distributed Database

- ✓ **Huge data can be stored in one Global center from different data center**
- ✓ Remote access is done using the global schema.
- ✓ Different DBMSs may be used at each node

Disadvantages of Heterogeneous Distributed Database

- ✓ **Difficult to mange**
- ✓ **Difficult to design.**

Classification as per Data Model



Database Models:-

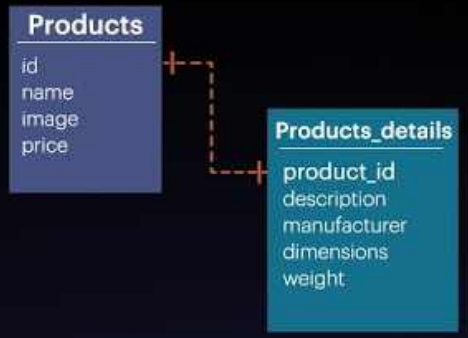
1) Network model
2) Hierarchical model
3) Relational model
4) Entity-Relationship data model (mainly for database design)
5) Object-based data models (Object oriented and Object-relational)
6) Semi-structured data model (XML)

redis

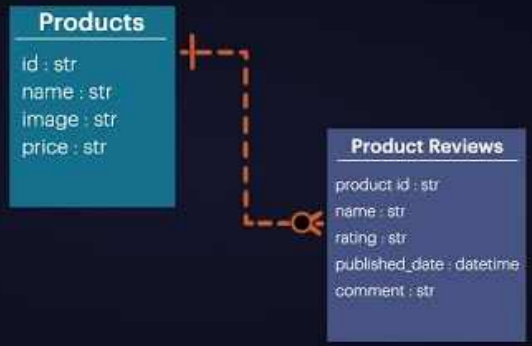
NoSQL

Data Modeling

1-to-1 Relationships



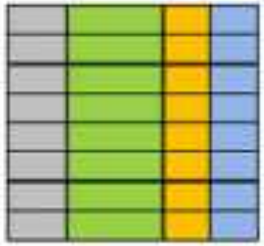
1-to-many Relationships



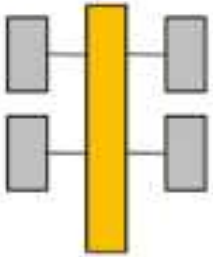
many-to-many Relationships

SQL Database

Relational

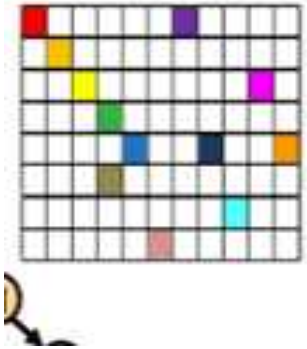


Analytical (OLAP)

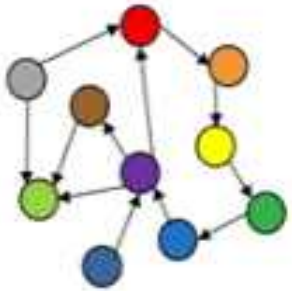


NoSQL Database

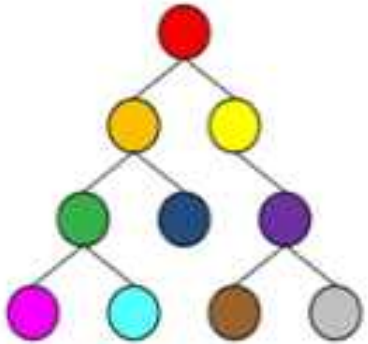
Column-Family



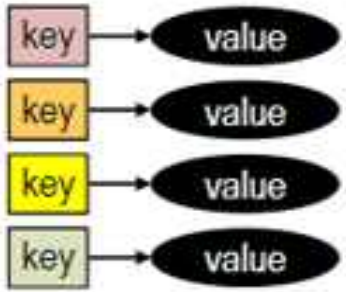
Graph



Document



Key-Value



Models

Post-relational database models

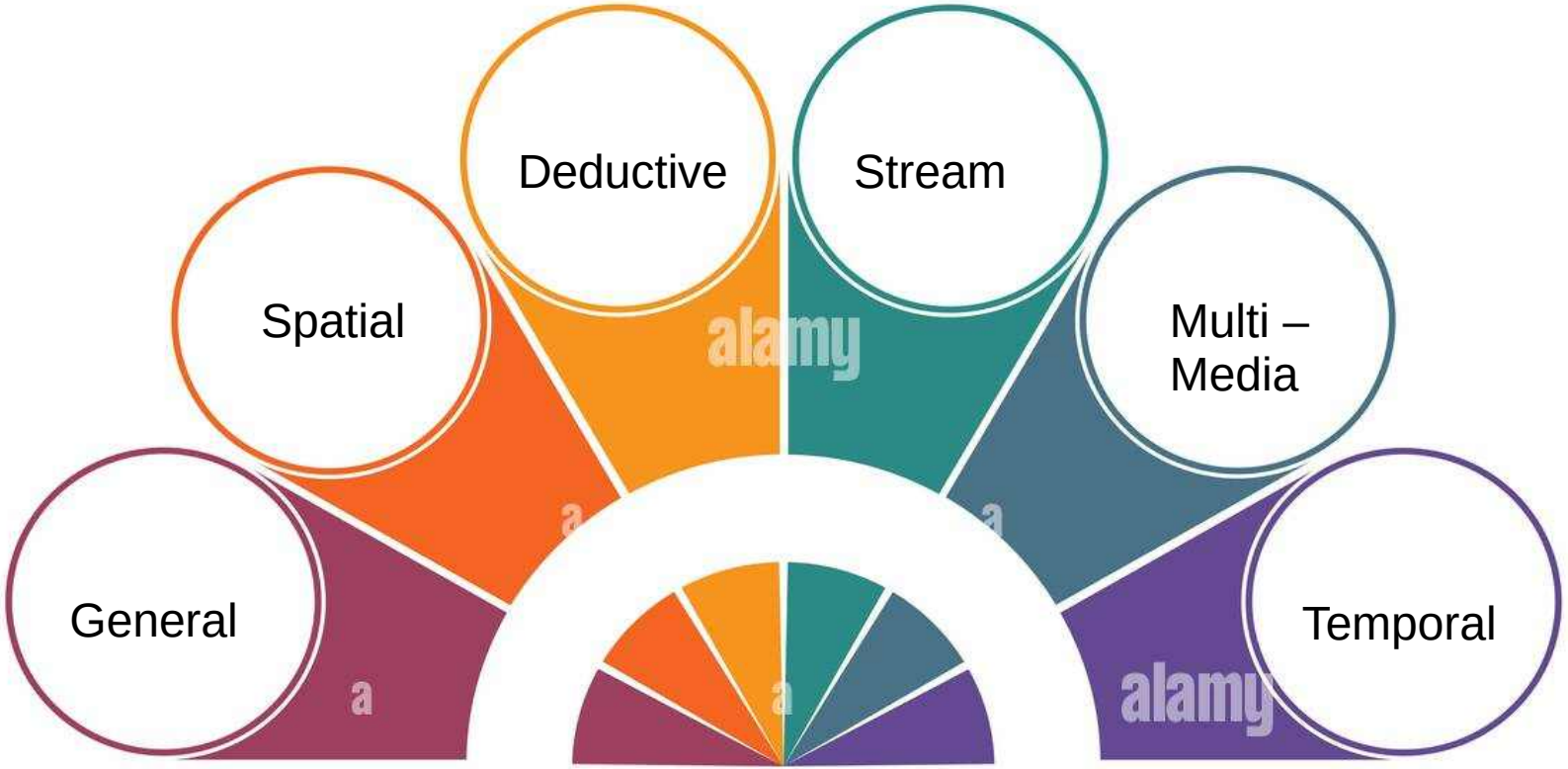
- Products offering a more general data model than the relational model are sometimes classified[by whom?] as post-relational. The data model in such products incorporates relations but is not constrained by the Information Principle[clarification needed], which requires the representation of all information by data values in relation to it.[original research?]
- Some of these extensions to the relational model actually integrate concepts from technologies that pre-date the relational model. For example, they allow representation of a directed graph with trees on the nodes.

Classification as per Usage

OPERATIONAL VS ANALYTICAL DATA MODELS

Operational Data Model	VS	Analytical Data Model
• Used to support day-to-day operations of an organization • Provides real-time access to a limited set of relevant data • Optimized for performance and scalability • Supports data entry, validation, and integrity constraints • Data is updated in close to real-time		• Used to support business intelligence and decision-making • Provides historical, complete and detailed data • Optimized for querying and reporting • Supports data analysis, data mining, and data visualization • Data is loaded on a schedule

Classification as per Data

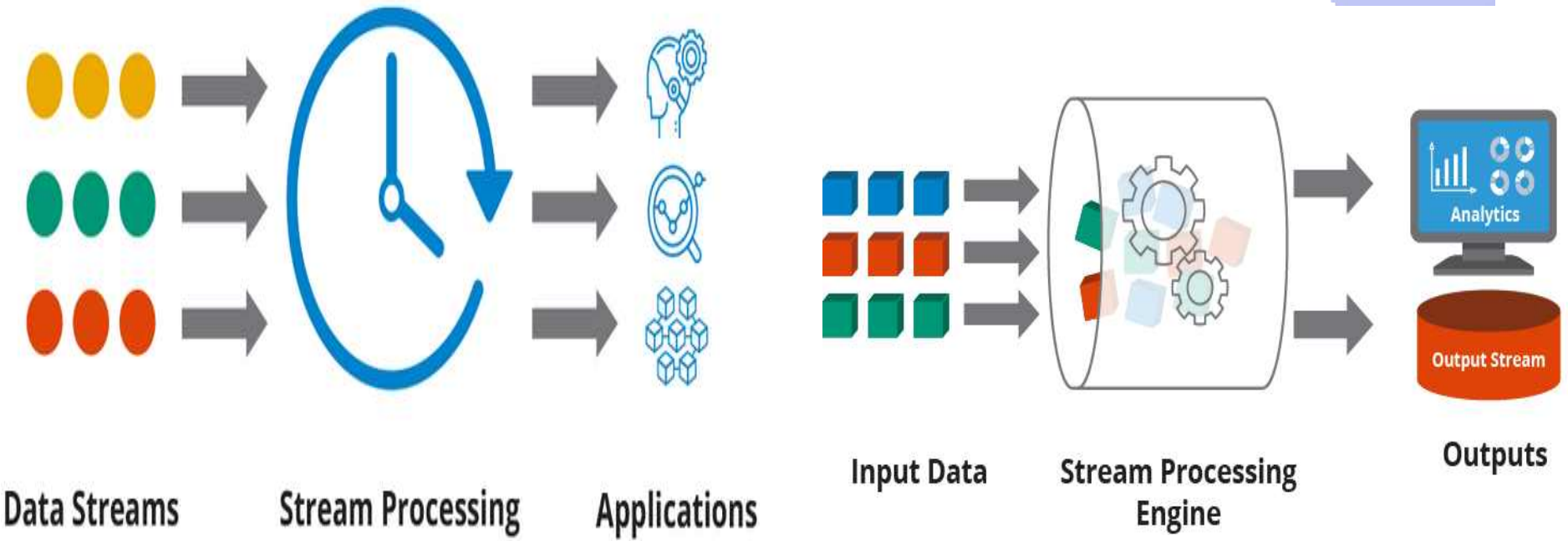


Spatial Data

- *Spatial* data, which means data related to *space*.
- Data that pertains to the space occupied by objects.
- Data that define a location.
- These are in the form of graphic primitives that usually either points, lines, polygons or pixels.
- Spatial data includes location, shape, size and orientation.
- For example: consider a particular square:
  - Its center (the intersection of its diagonals) specifies its location
  - Its shape is square
  - The length of one of its sides specifies its size
  - The angle of its diagonals make with, say, x-axis specifies its orientation.

Data Streams

- A **data stream** is a (potentially unbounded) sequence of tuples. Each tuple consist of a set of attributes, similar to a row in database table.
- **Transactional** data streams: log interactions between entities
  - Credit card: purchases by consumers from merchants
  - Telecommunications: phone calls by callers to dialed parties
  - Web: accesses by clients of resources at servers
- **Measurement** data streams: monitor evolution of entity states
  - Sensor networks: physical phenomena, road traffic
  - IP network: traffic at router interfaces
  - Earth climate: temperature, moisture at weather stations


Data Streams
Stream Processing
Applications
Input Data
Stream Processing Engine
Analytics
Output Stream
Outputs

Multimedia Databases

- A Multimedia database (MMDB) is a collection of related multimedia data, which include one or more primary media data types such as text , images, graphic objects (including drawings, sketches and illustrations) animation sequences, audio and video .

A Multimedia Database Management System (MMDBMS) is a framework that manages different types of data potentially represented in a wide diversity of formats . It provides support for multimedia data types, and facilitate for creation, storage, access, query and control of a multimedia database.

Contents of MMDB

- A Multimedia Database (MMDB) hosts one or more multimedia data types . These data types are broadly categorized into ***three classes***::
- **Static media**

  (time independent, constant, non interactive e.g. image and graphic object).
- **Dynamic media**

  (time dependent, moving, interactive, e.g. Audio , video and animation).
- **Dimensional media**

  (3D game and computer aided drafting programs). E.g. virtual reality, 9-D movies

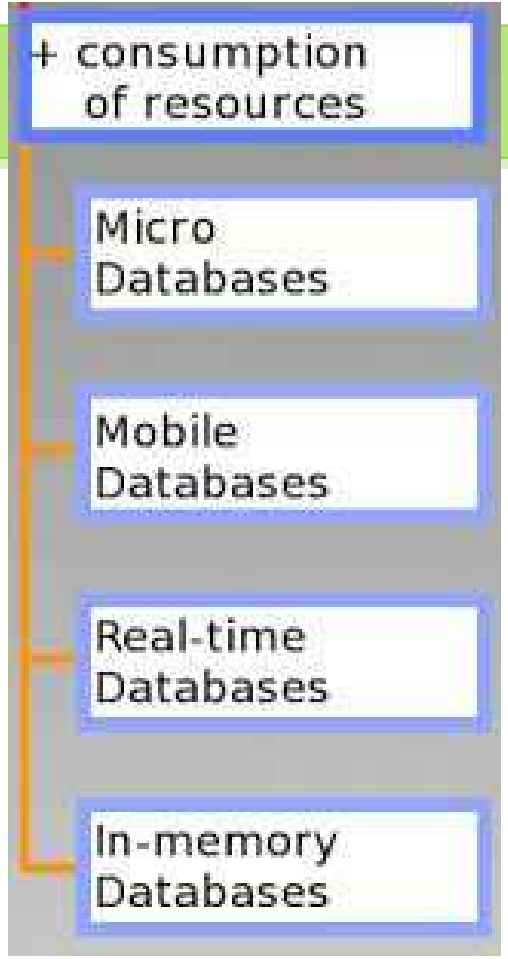
Temporal database

- A **temporal database** stores data relating to time instances.
- It offers **temporal** data types and stores information relating to past, present and future time.
- Transaction time is the time period during which a fact stored in the **database** in the **database** was known. Bi temporal data combines both Valid and Transaction Time.

•What is a deductive database system?

A deductive database can be defined as an advanced database augmented with an inference system.

By evaluating rules against facts, new facts can be derived, which in turn can be used to answer queries. It makes a database system more powerful.


+ consumption of resources
Micro Databases
Mobile Databases
Real-time Databases
In-memory Databases