

# Introdução à Banco de dados

*Trilha de Banco de Dados Relacional*

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Tech Education Specialist DIO / Owner @Simplificandoredes  
e @SimplificandoProgramação

Mestre em modelagem computacional | Cientista de dados

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## **Juliana Mascarenhas**

Tech Education Specialist

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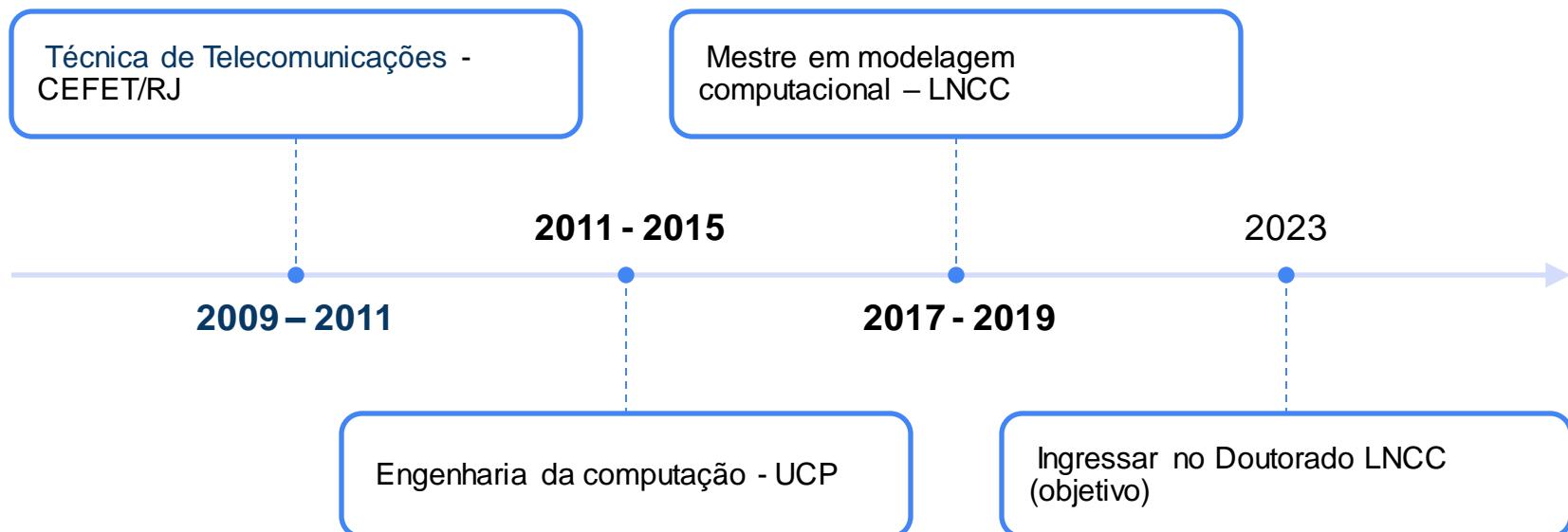
@SimplificandoProgramação

Cientista de dados

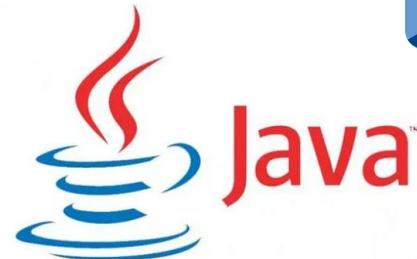
Desenvolvedora Java/Python

Me Modelagem Computacional - LNCC

# Sobre Mim



# Sobre Mim



PostgreSQL



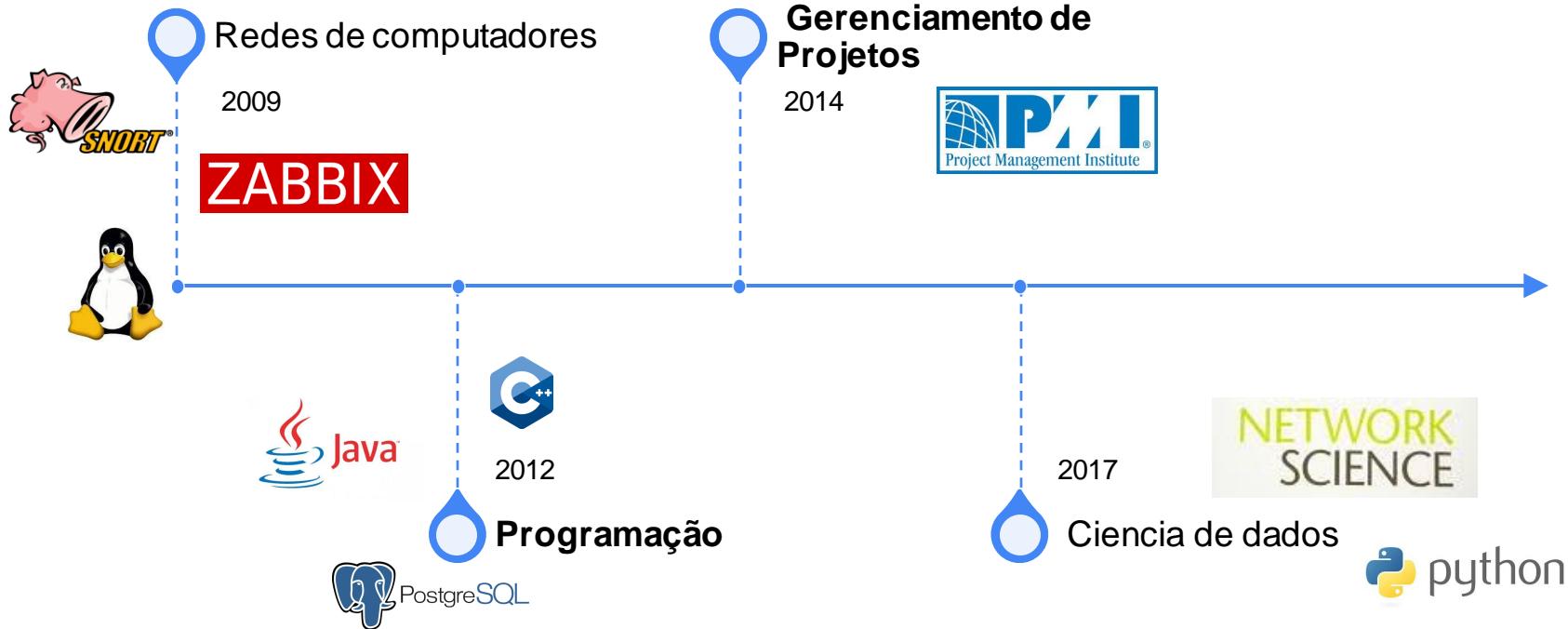
APACHE



ZABBIX



# Sobre Mim



# Cursos

## Conhecendo os principais protocolos de comunicação da internet

HTTP | Web socket

**Juliana Mascarenhas**

Tech Education Specialist / Sócia - criadora de conteúdo no @Simplificandoredes e @SimplificandoProgramação

Mestre em modelagem computacional

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Waiting for file-powerpoint.html to open...



## Introdução à Programação e Pensamento Computacional

Curso base para iniciante

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Me Modelagem Computacional / Cientista de dados

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## Criando um Microserviço de Upload de Imagens com o Amazon S3

Juliana Mascarenhas  
Me. Modelagem Computacional



## Criando uma API REST conectada a Amazon RDS com Java

Juliana Mascarenhas  
Me. Modelagem Computacional



## Java Spring com RabbitMQ

Juliana Mascarenhas  
Mestre em modelagem computacional

# Objetivo Geral

Objetivo deste módulo é apresentar o mundo da modelagem de dados voltado para um sistema de banco de dados. Dessa forma, o dev irá dar seu primeiro mergulho no mundo de Banco de dados obtendo uma visão geral sobre o assunto.

# Objetivo Geral



## Contextualização

Histórico  
O que são BDs ?  
Era dos dados



## Introdução à Modelagem de Dados

Modelagem e SQL  
Instalando e Configurando seu SGBD



Características principais  
StakeHolders  
Vantagens e quando não usar?



## Explorando SGBDs



Modelos, Esquemas, linguagens, ambientes ....

## Arquitetura de SGBDs

## Etapa 1

# Contextualizando – O que são banco de dados?

// Introdução à Banco de dados

# Conversa

## Cenário de dados

Contextualizando

## SGBDs

Sistemas de Gerenciamento de BDs

O que são Banco de dados?

# Contextualizando



# Contextualizando

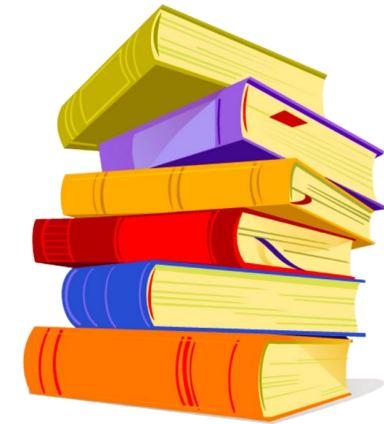


# Contextualizando



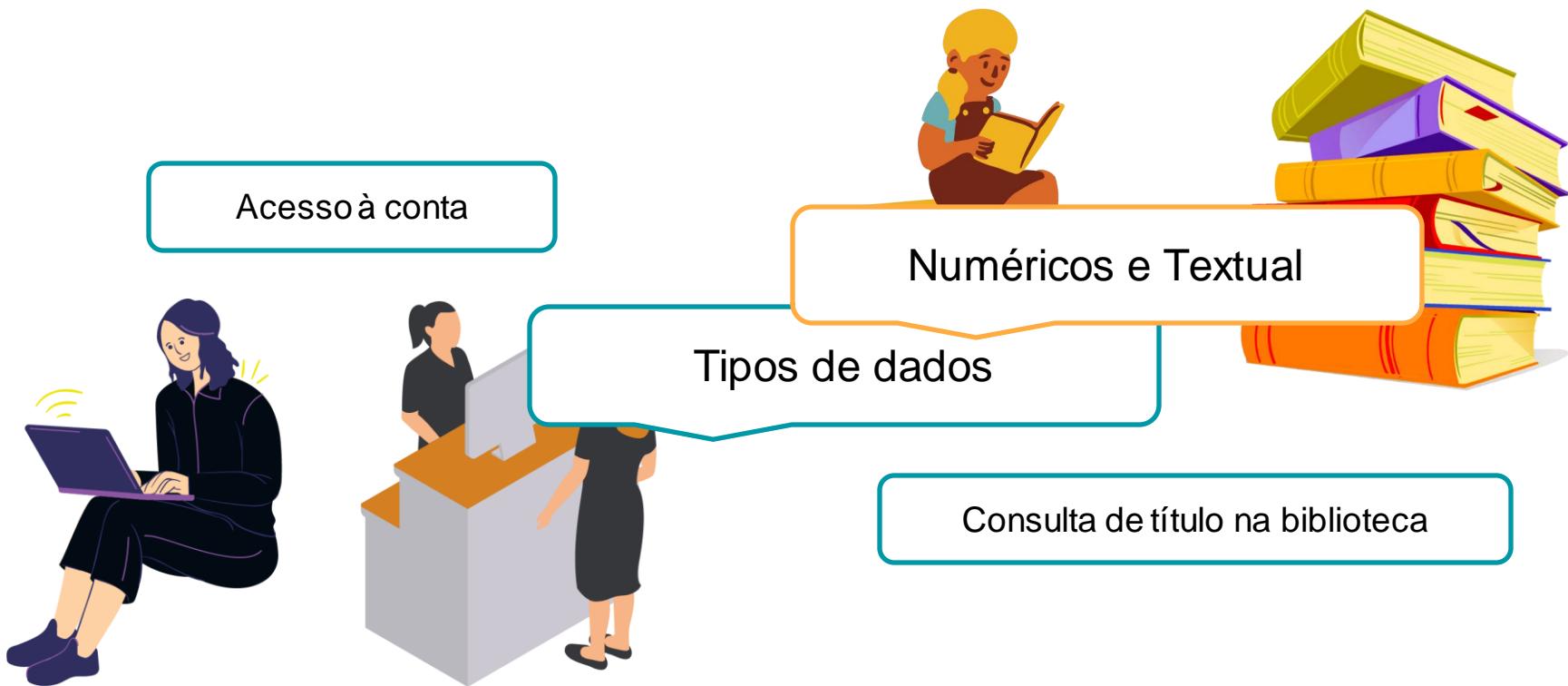
# Contextualizando

Acesso à conta

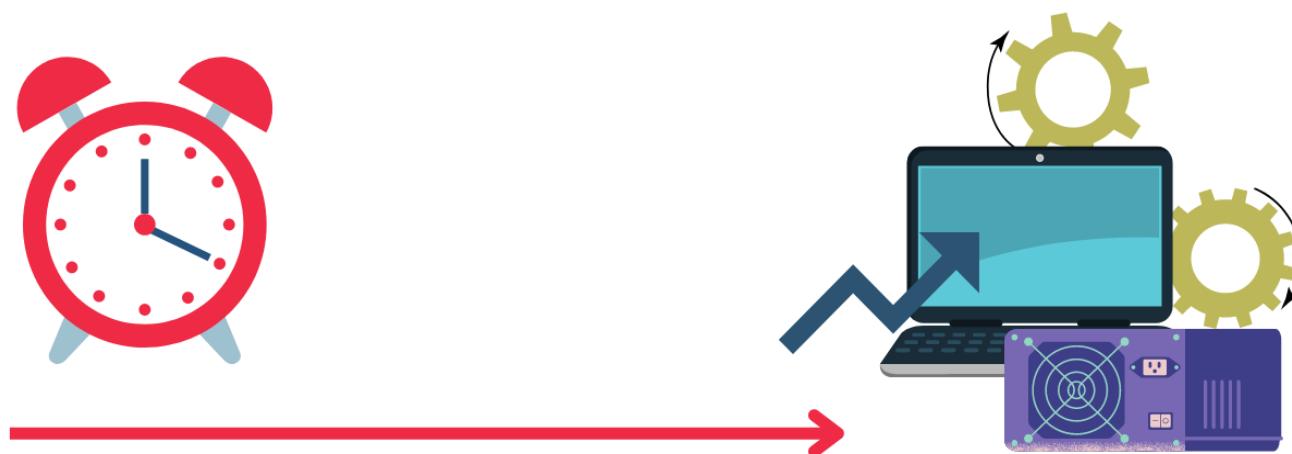


Consulta de título na biblioteca

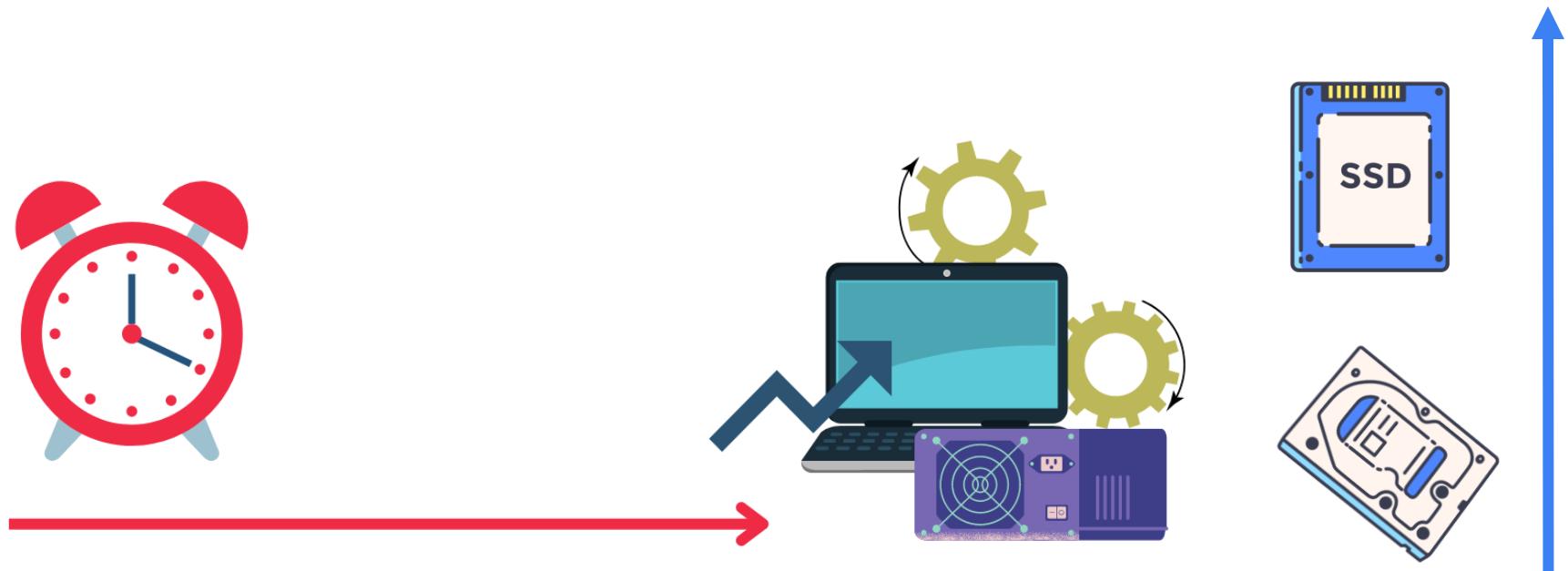
# Contextualizando



# Contextualizando



# Contextualizando



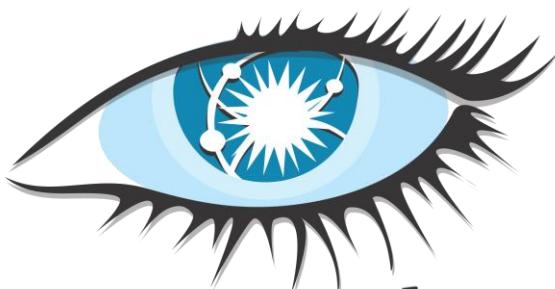
# Contextualizando



# Contextualizando



# Contextualizando



*cassandra*



mongoDB®



redis

# O que são banco de dados?



# O que são Banco de Dados?

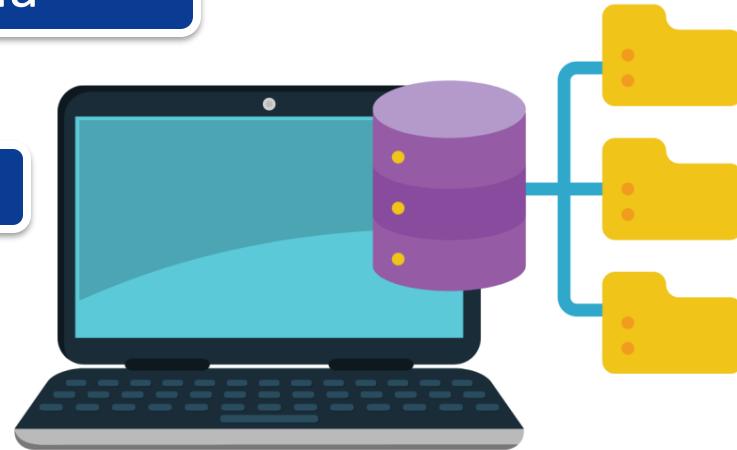
Negócios

E-commerce

Engenharia

Medicina

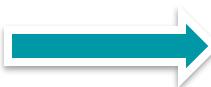
Social Media



# O que são Banco de Dados?

Formalmente:

- Dados relacionados



Database



Fatos

# O que são Banco de Dados?

## CADASTRO

Nome  
Telefone  
Email  
Whats app



Significado

# O que são Banco de Dados?

Podemos considerar uma coleção de palavras, que dentre elas há relacionamentos entre dados, constituindo então um banco de dados.

Definição geral

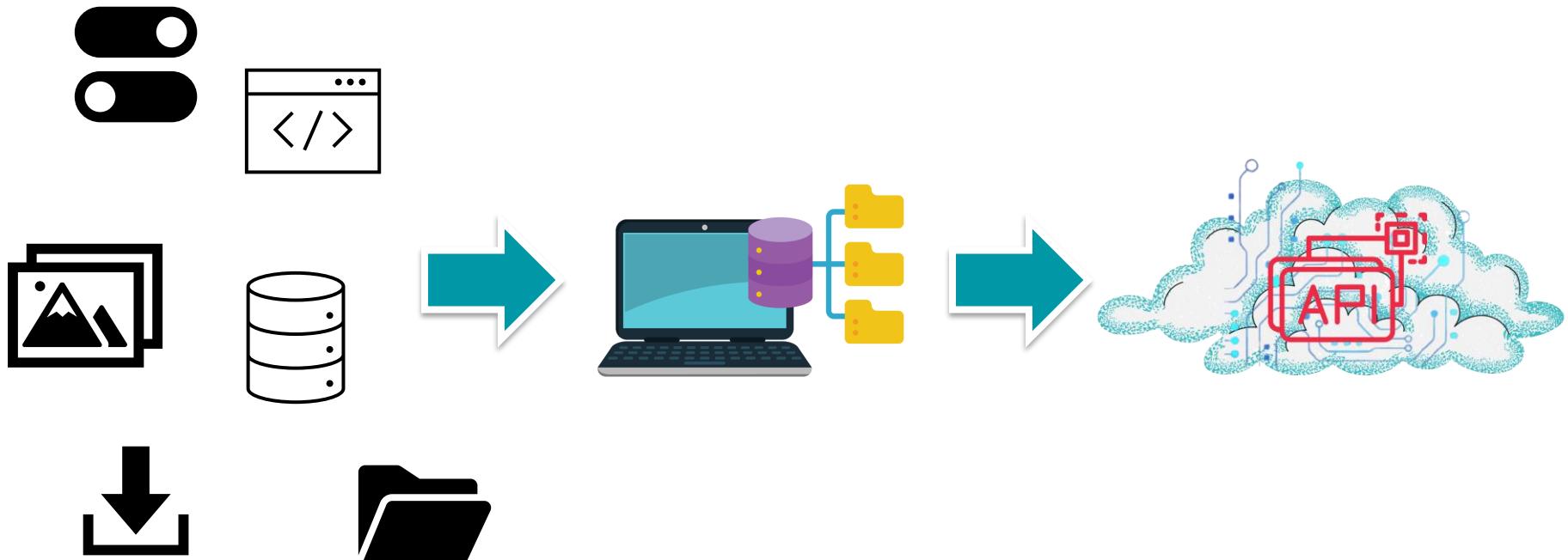
# O que são Banco de Dados?



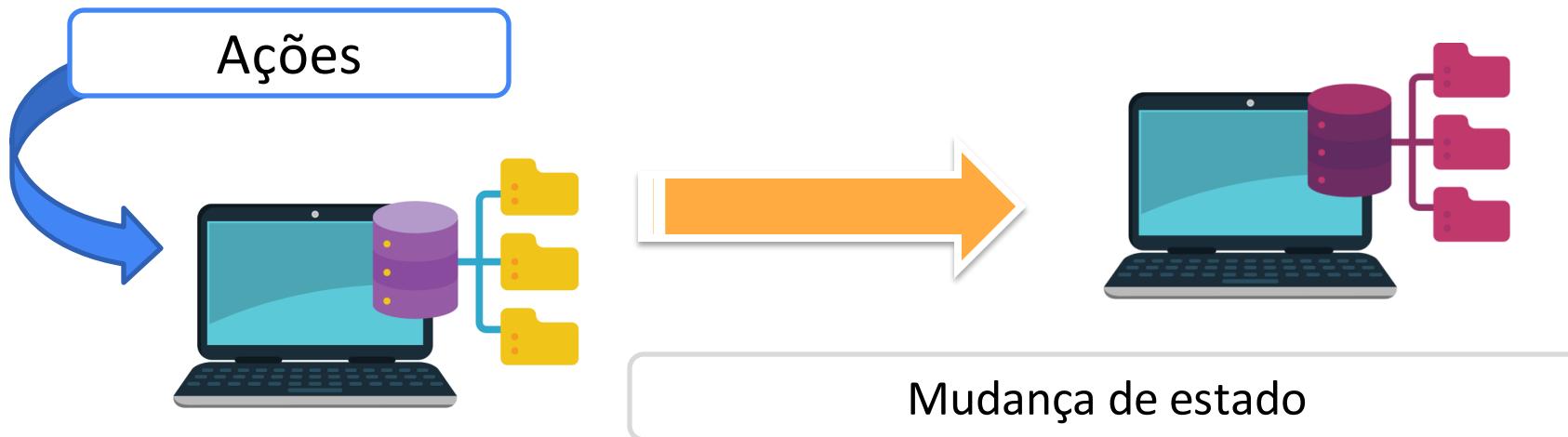
- Contexto - representação do mundo real;
- Coerência;
- Propósito

Uso + restrito

# O que são Banco de Dados?



# O que são Banco de Dados?

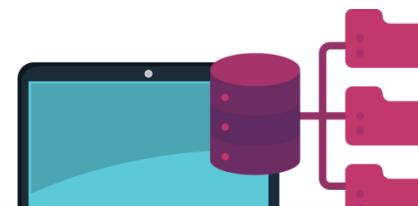
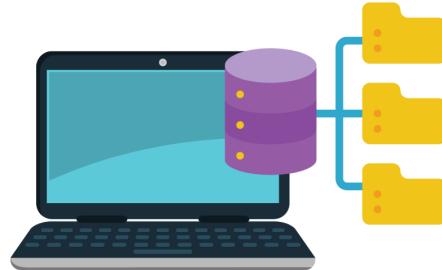


# O que são Banco de Dados?

Confiável

Acurado

Ações



Reflexo "imediato"

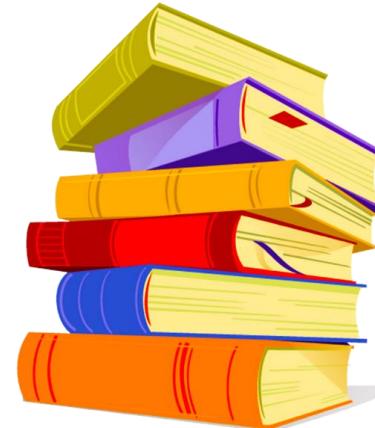
Mudança de estado

# O que são Banco de Dados?

Tamanho?



Centenas



Bilhões



# O que são Banco de Dados?



*friends*

Complexidade



Manutenção do modelo e estado do bd

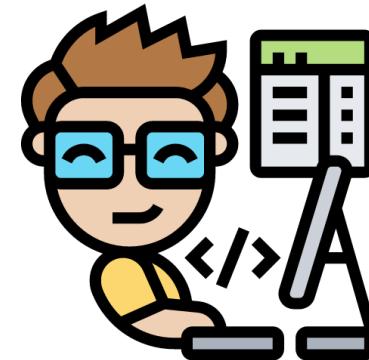
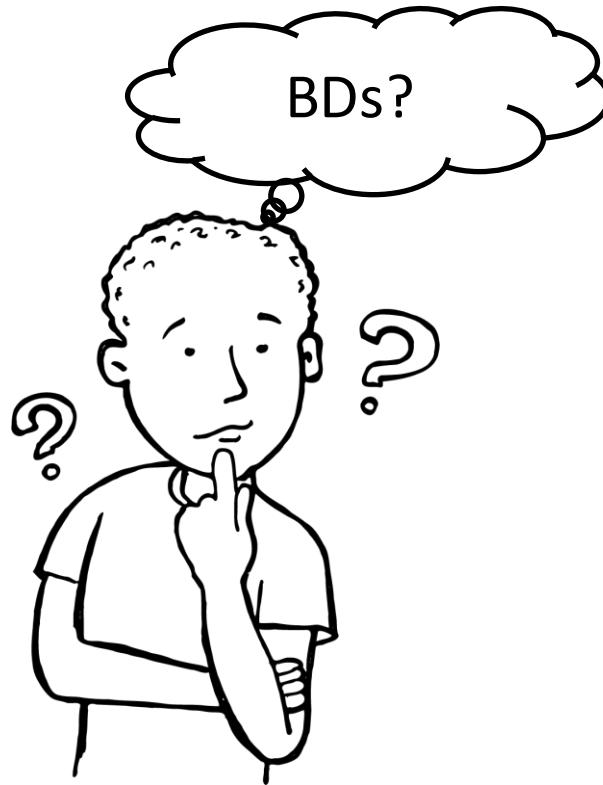
# O que são Banco de Dados?



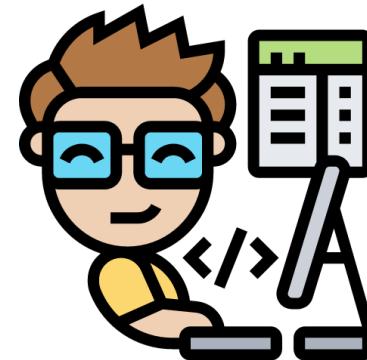
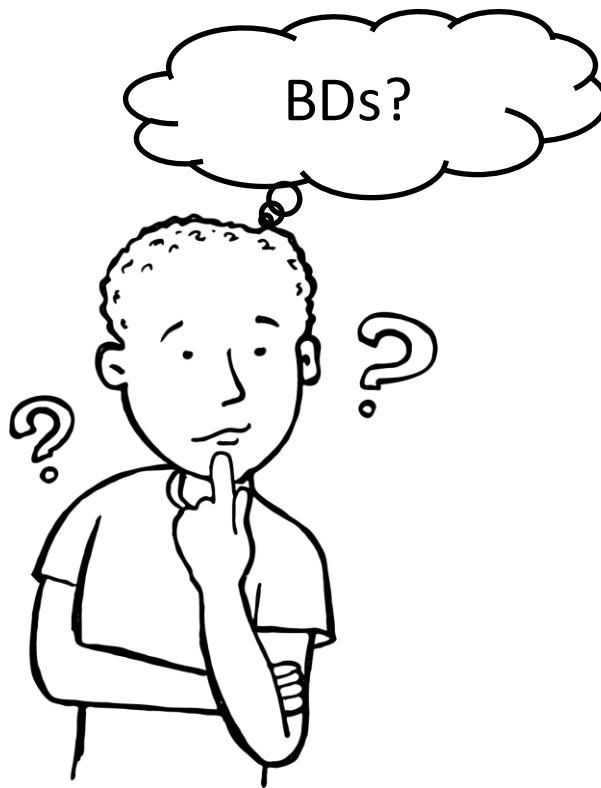
amazon

- 60 milhões de users
- 42 Terabytes
- SGBD distribuído

# O que são Banco de Dados?



# O que são Banco de Dados?

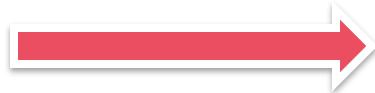


# SGBDs - Sistemas de Gerenciamento de Banco de Dados



# SGBDs

- Definição
- Construção
- Manipulação
- Compartilhamento



Tipo de dados

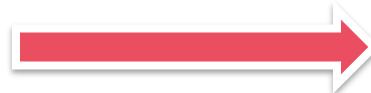
Estrutura

Constrains

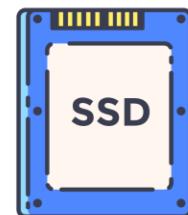
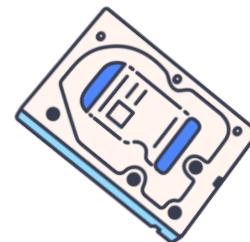
Software de propósito geral

# SGBDs

- Definição
- Construção
- Manipulação
- Compartilhamento



Inserção de dados



Software de propósito geral

# SGBDs

- Definição
- Construção
- Manipulação
- Compartilhamento

Recuperação

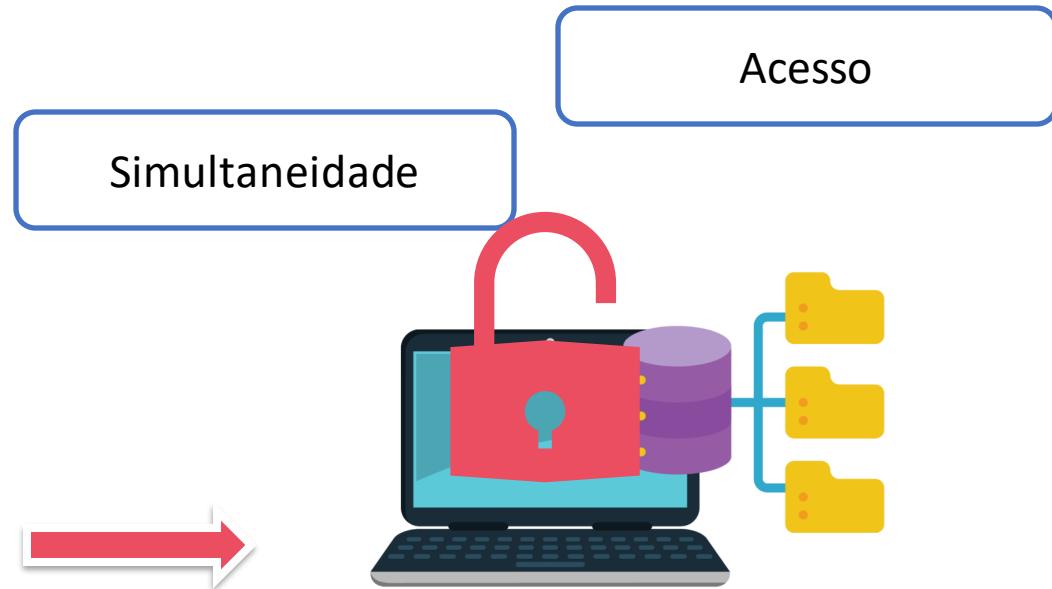
Relatórios



Software de propósito geral

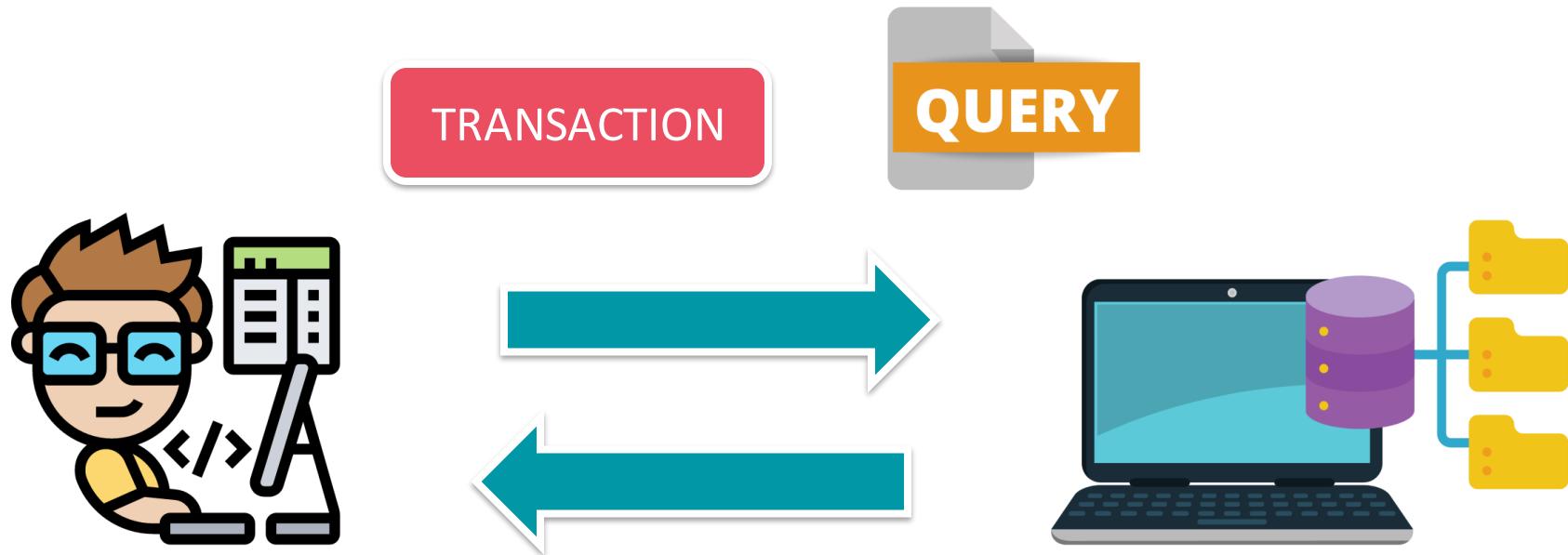
# SGBDs

- Definição
- Construção
- Manipulação
- Compartilhamento



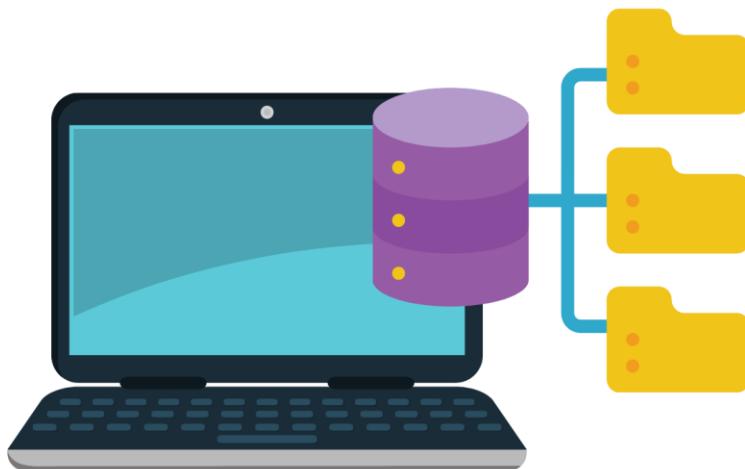
Software de propósito geral

# SGBDs



Retorno: dados

# SGBDs



Além disso ...

Acesso

Mal funcionamento

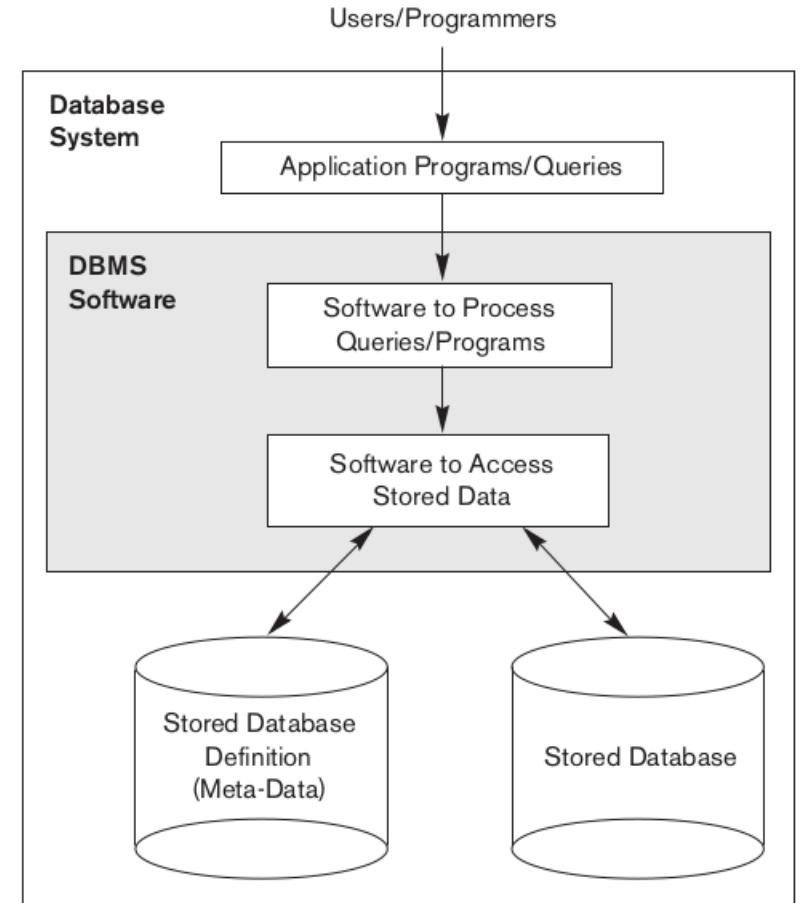
Proteção

Ciclo de vida de longo prazo

# SGBDs - Exemplo

Contexto: Universidade

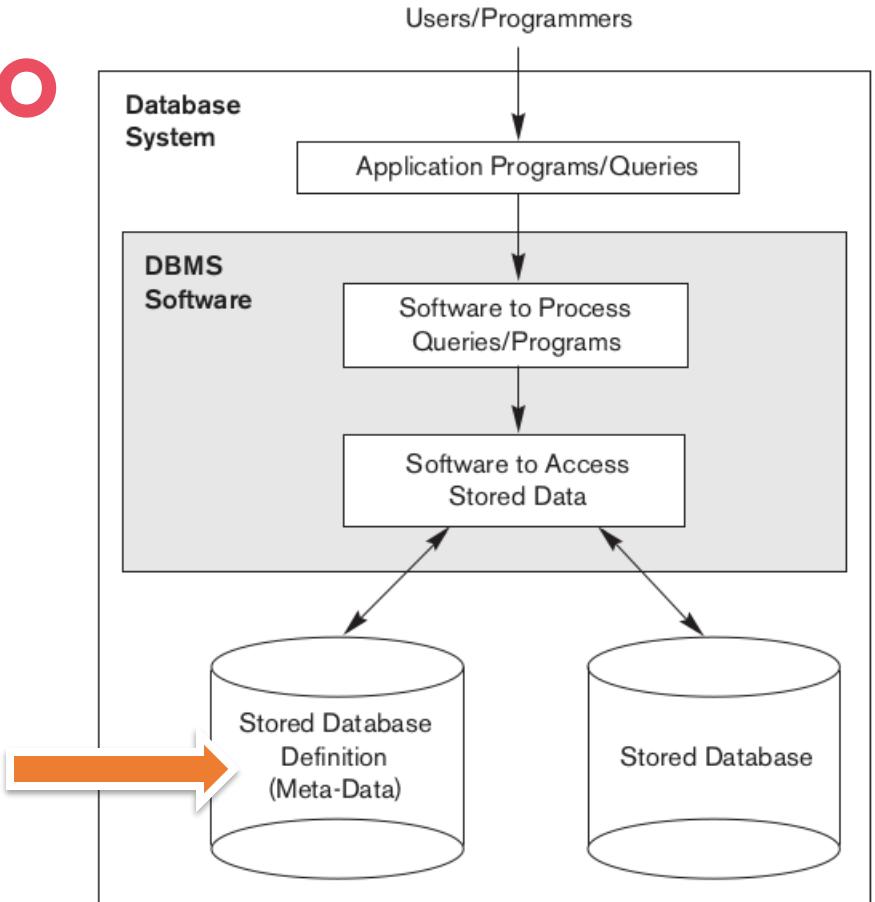
- Nome completo
- Matrícula
- Endereço
- Campus
- Curso
- Telefone
- Email
- ...



# SGBDs - Exemplo

## Definição

- Estudantes
- Cursos
- Seção
- Pré-requisitos
- Report da grade



# SGBDs - Exemplo

## Definição

- Estudantes
- Cursos
- Seção
- Pré-requisitos
- Report da grade

COURSE

| Course_name               | Course_number | Credit_hours | Department |
|---------------------------|---------------|--------------|------------|
| Intro to Computer Science | CS1310        | 4            | CS         |
| Data Structures           | CS3320        | 4            | CS         |
| Discrete Mathematics      | MATH2410      | 3            | MATH       |
| Database                  | CS3380        | 3            | CS         |

STUDENT

| Name  | Student_number | Class | Major |
|-------|----------------|-------|-------|
| Smith | 17             | 1     | CS    |
| Brown | 8              | 2     | CS    |

SECTION

| Section_identifier | Course_number | Semester | Year | Instructor |
|--------------------|---------------|----------|------|------------|
| 85                 | MATH2410      | Fall     | 07   | King       |
| 92                 | CS1310        | Fall     | 07   | Anderson   |
| 102                | CS3320        | Spring   | 08   | Knuth      |
| 112                | MATH2410      | Fall     | 08   | Chang      |
| 119                | CS1310        | Fall     | 08   | Anderson   |
| 135                | CS3380        | Fall     | 08   | Stone      |

GRADE\_REPORT

| Student_number | Section_identifier | Grade |
|----------------|--------------------|-------|
| 17             | 112                | B     |
| 17             | 119                | C     |
| 8              | 85                 | A     |
| 8              | 92                 | A     |
| 8              | 102                | B     |
| 8              | 135                | A     |

PREREQUISITE

| Course_number | Prerequisite_number |
|---------------|---------------------|
| CS3380        | CS3320              |
| CS3380        | MATH2410            |
| CS3320        | CS1310              |

# SGBDs - Exemplo

## Definição

- Estudantes
- Cursos
- Seção
- Pré-requisitos
- Report da grade

## Tipos de dado

**COURSE**

| Course_name               | Course_number | Credit_hours | Department |
|---------------------------|---------------|--------------|------------|
| Intro to Computer Science | CS1310        | 4            | CS         |
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**GRADE\_REPORT**

| Student_number | Section_identifier | Grade |
|----------------|--------------------|-------|
| 17             | 112                | B     |
| 17             | 119                | C     |
| 8              | 85                 | A     |
| 8              | 92                 | A     |
| 8              | 102                | B     |
| 8              | 135                | A     |

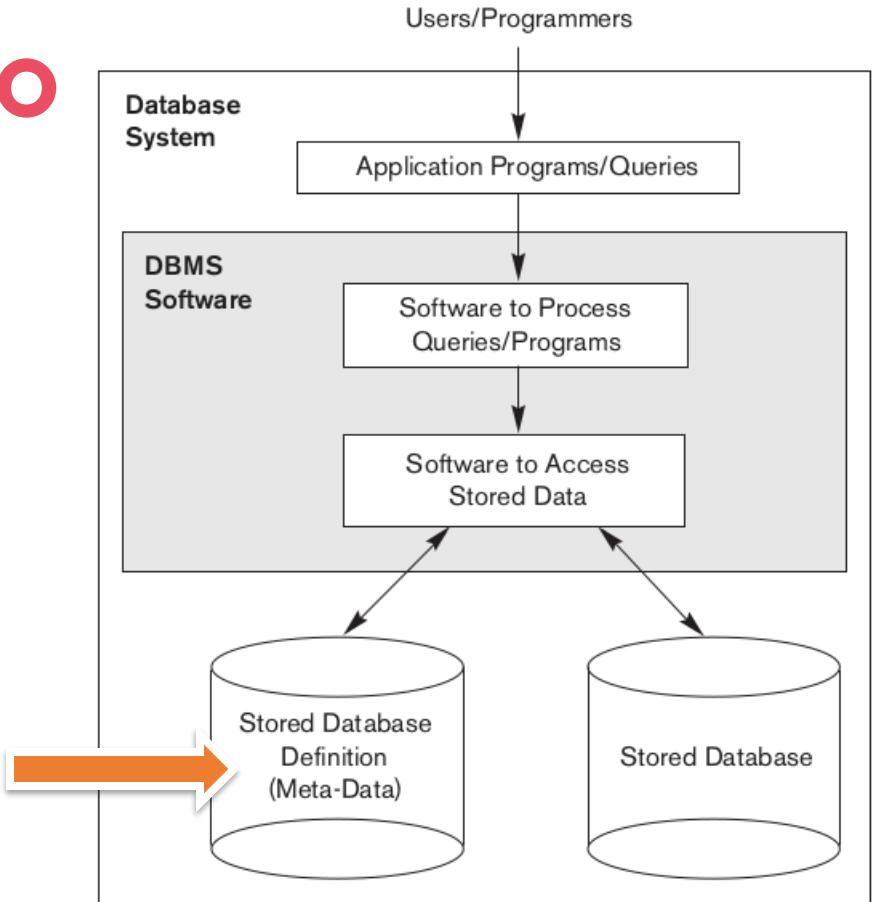
**PREREQUISITE**

| Course_number | Prerequisite_number |
|---------------|---------------------|
| CS3380        | CS3320              |
| CS3380        | MATH2410            |
| CS3320        | CS1310              |

# SGBDs - Exemplo

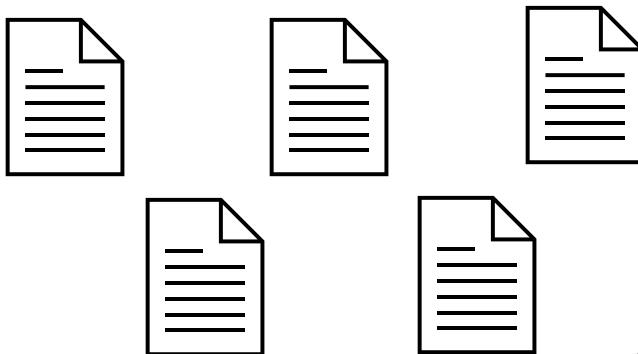
## Metadados

Informações que fornecem uma descrição concisa dos dados contidos no BD

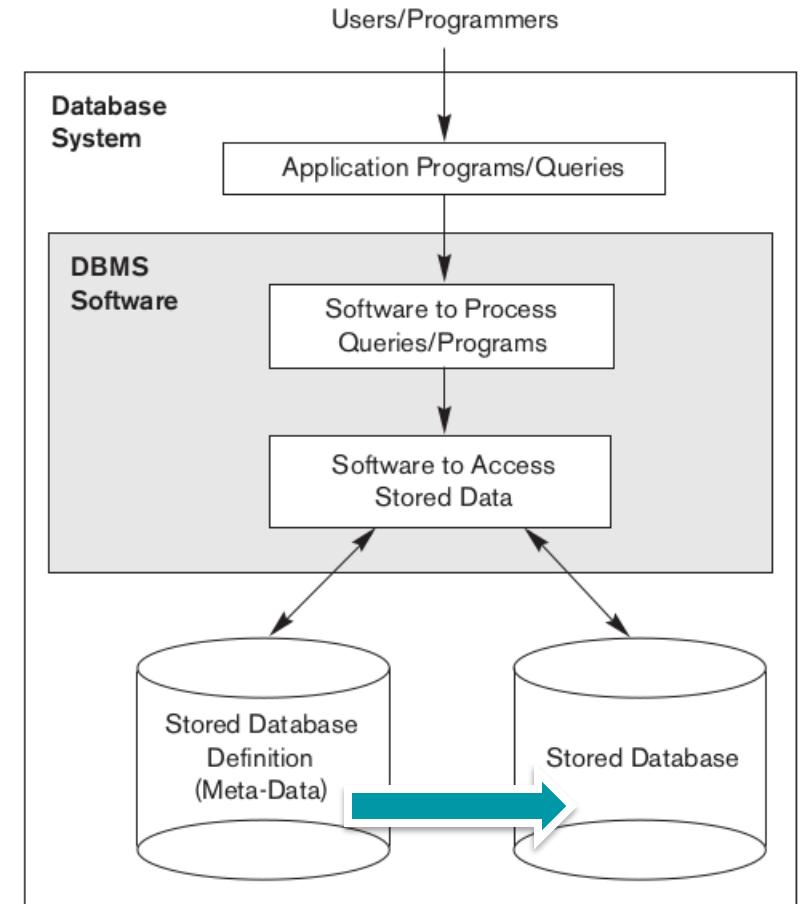


# SGBDs - Exemplo

Construção



Arquivos

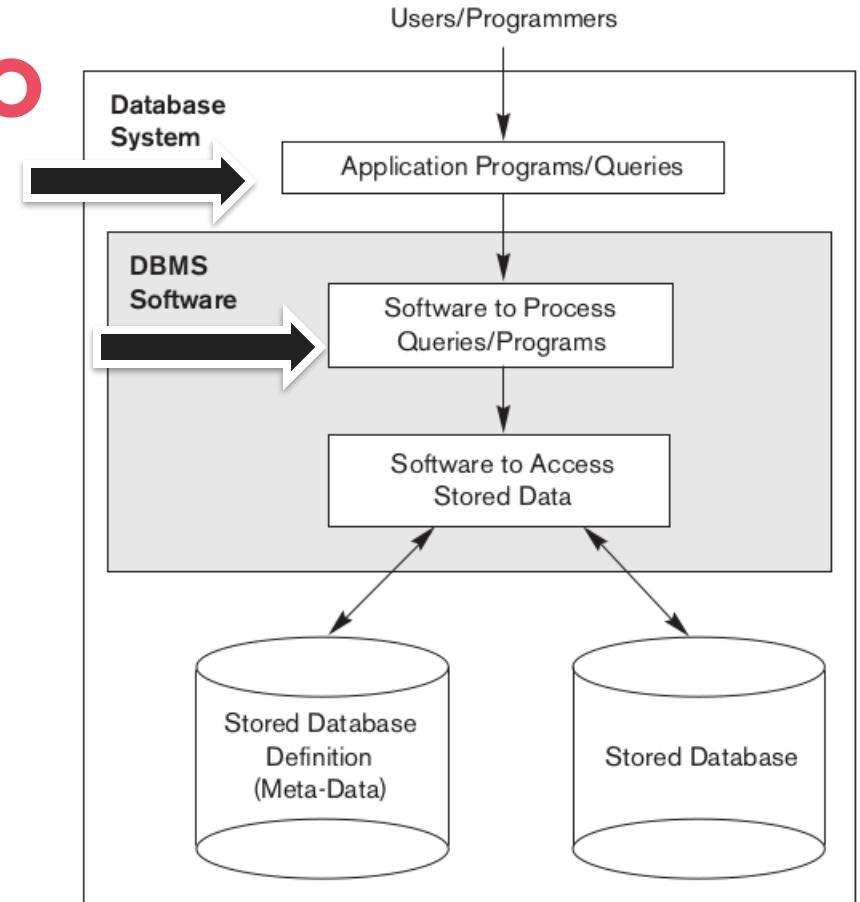


# SGBDs - Exemplo

Manipulação

QUERY

Updates

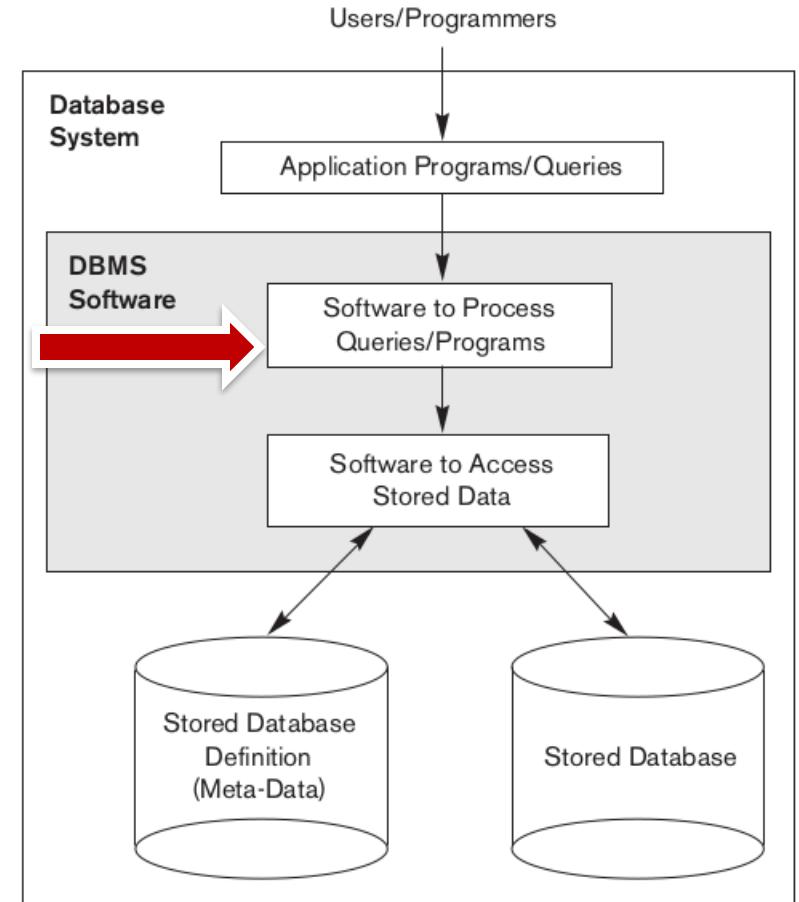


# SGBDs - Exemplo

Compartilhamento

Por padrão o BD realiza o bloqueio e a liberação das tabelas

Transações



## Etapa 2

# Contextualizando – breve histórico e conceitos

// Introdução à Banco e dados

# Conversa

## Breve histórico

Como surgiu?

## Mercado

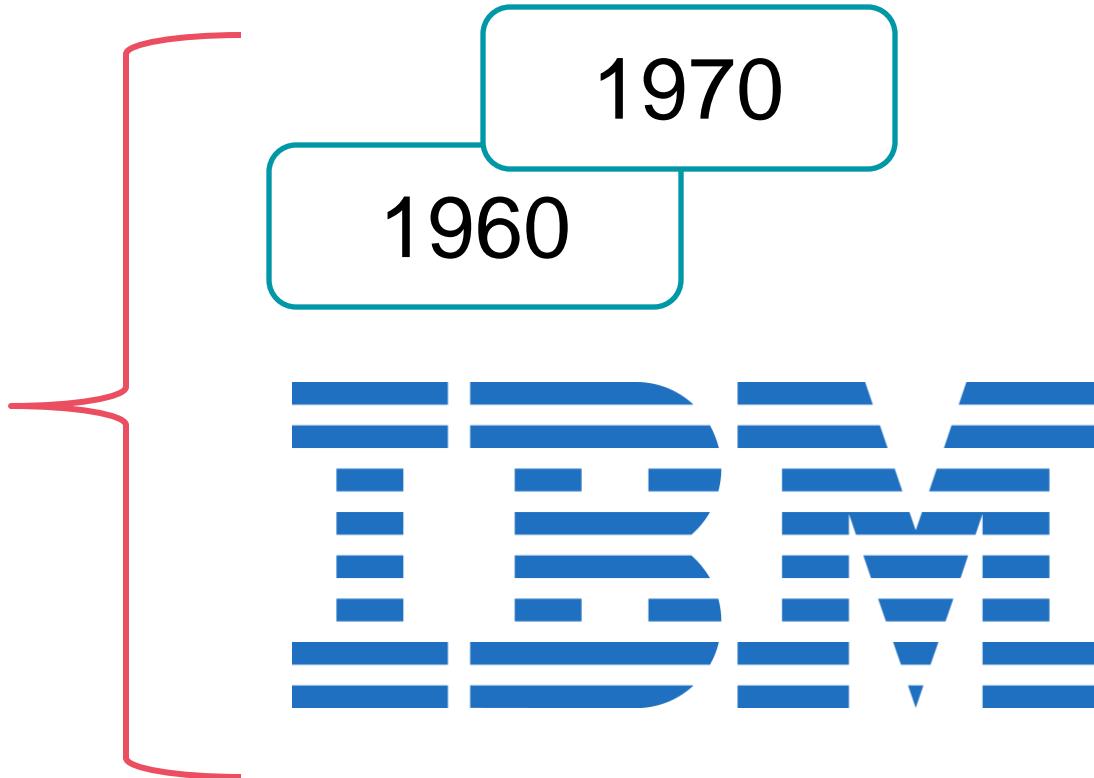
Sistemas de Gerenciamento de BDs mais utilizados

Visão geral de características e propriedades

## Modelo de BD Relacional

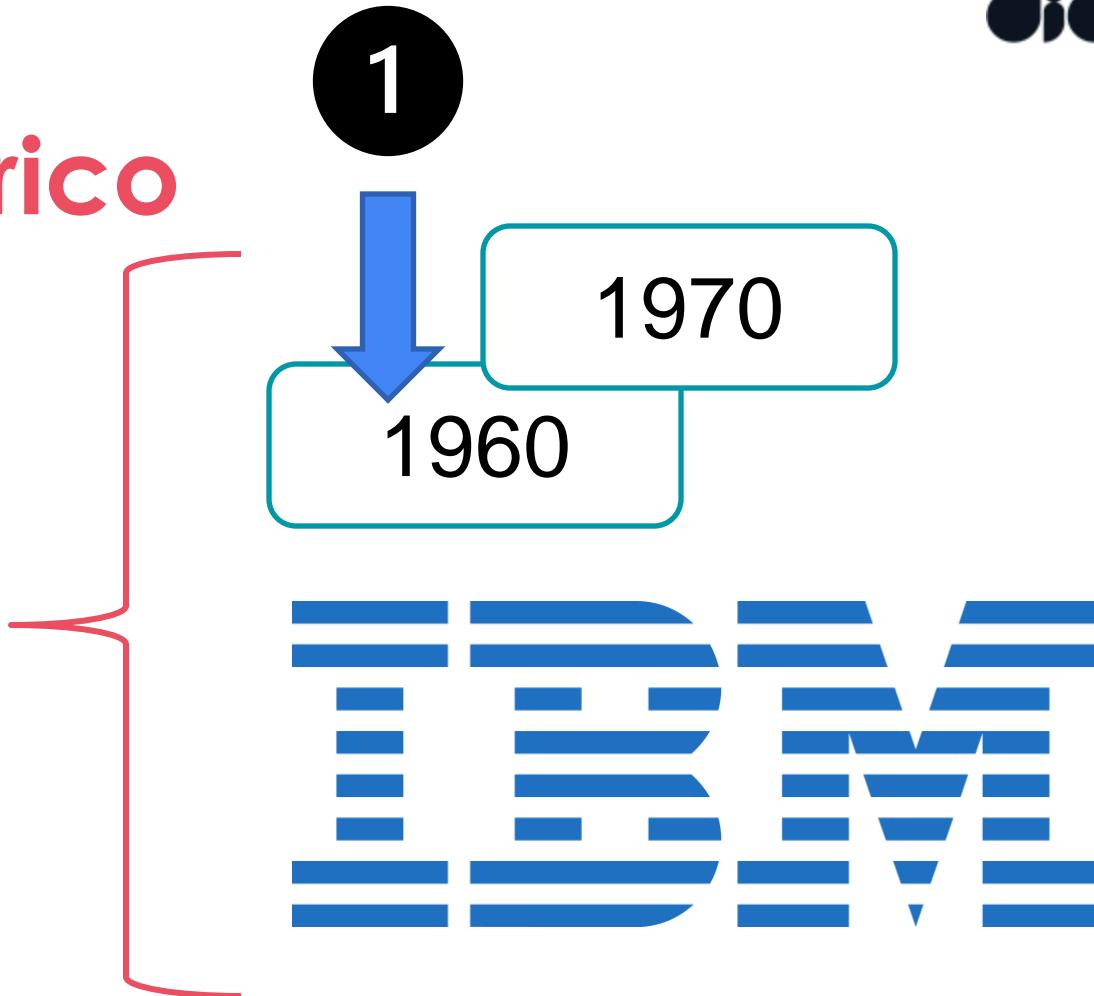
# Breve Histórico

Modelo Relacional  
de BDs

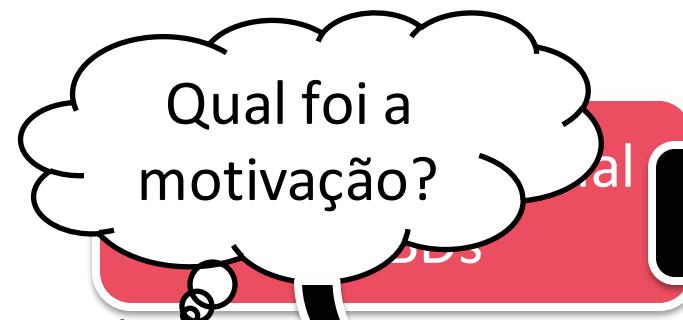


# Breve Histórico

Modelo Relacional  
de BDs



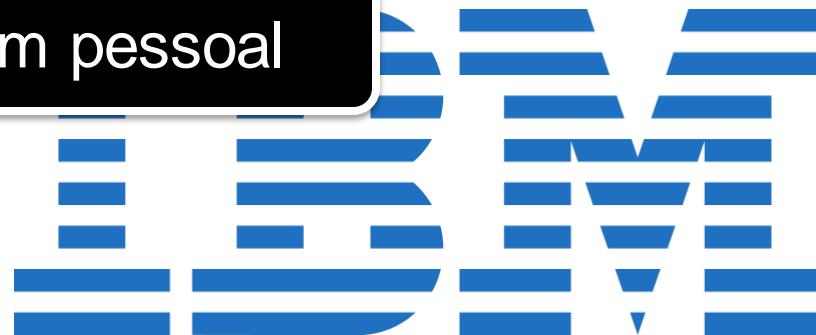
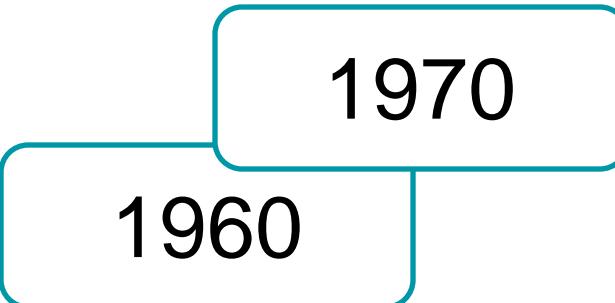
# Breve Histórico



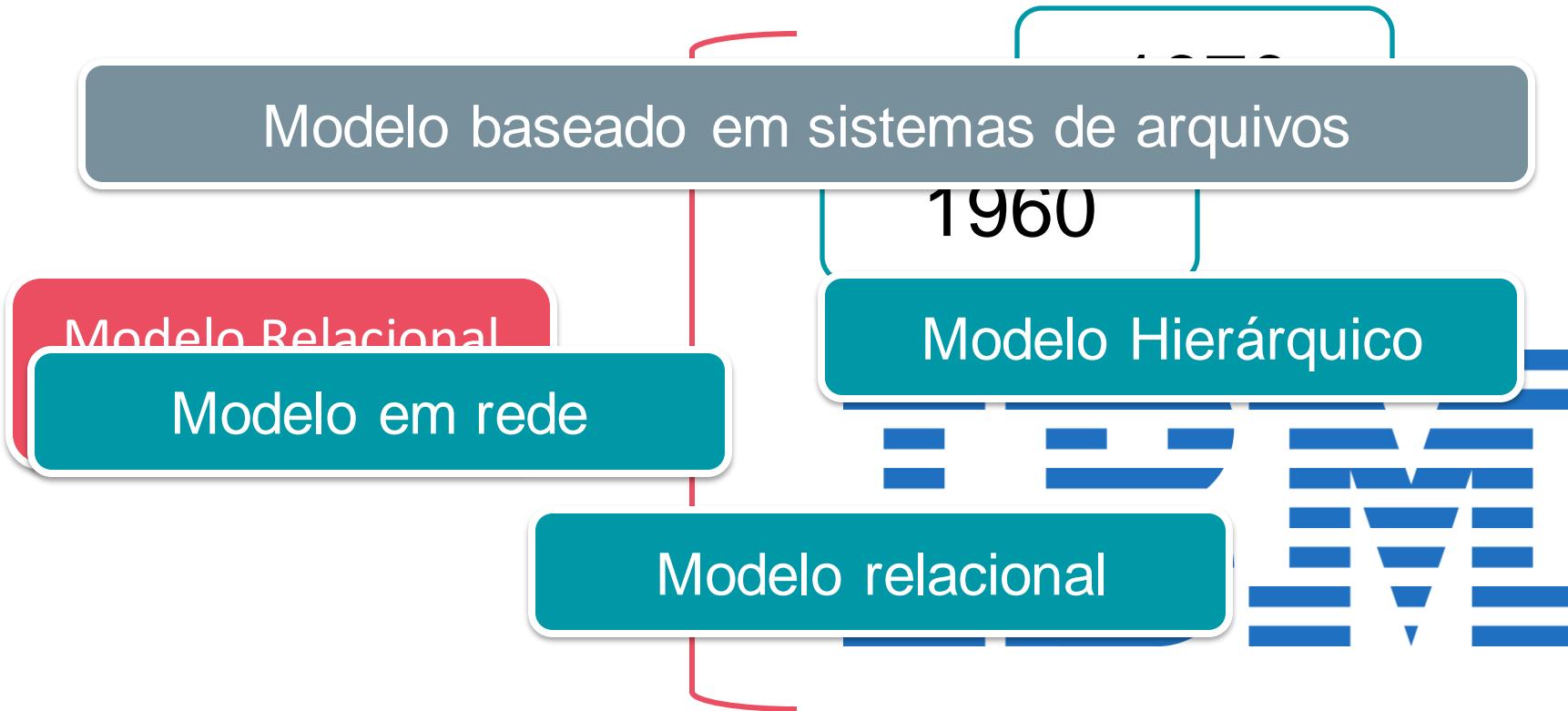
Custo com pessoal

1960

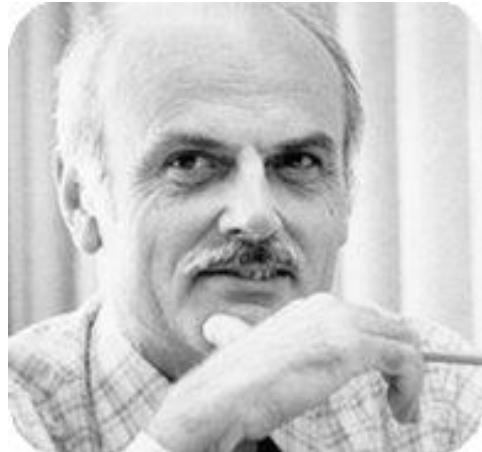
1970



# Breve Histórico



# Breve Histórico



Criador: Ted Codd

Cálculo e Álgebra Relacional

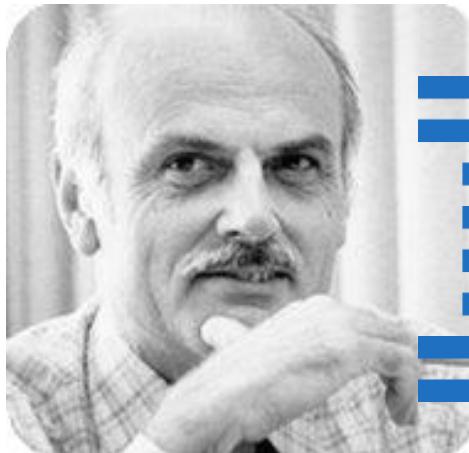


Artigo

1970

# Breve Histórico

Cálculo e Álgebra Relacional

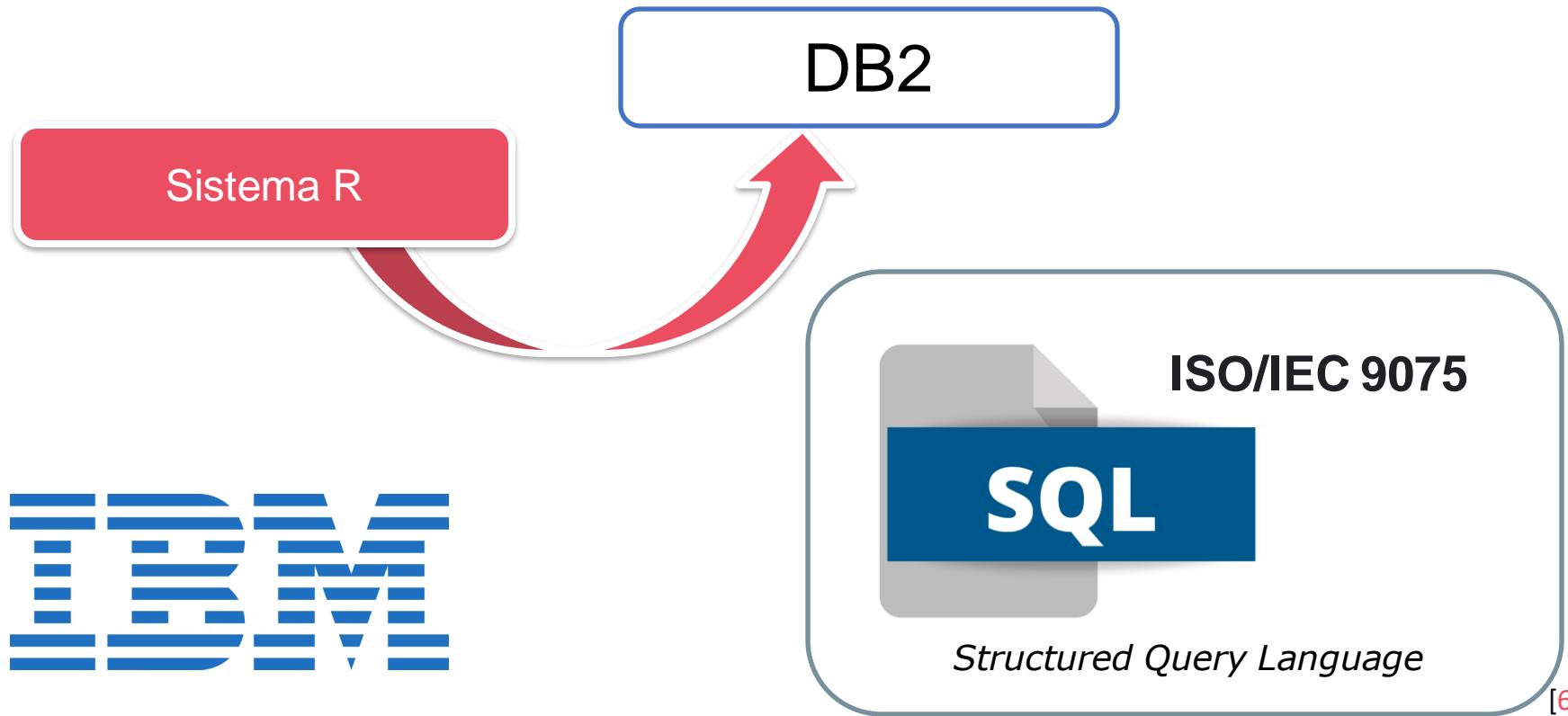


Criador: Ted Codd

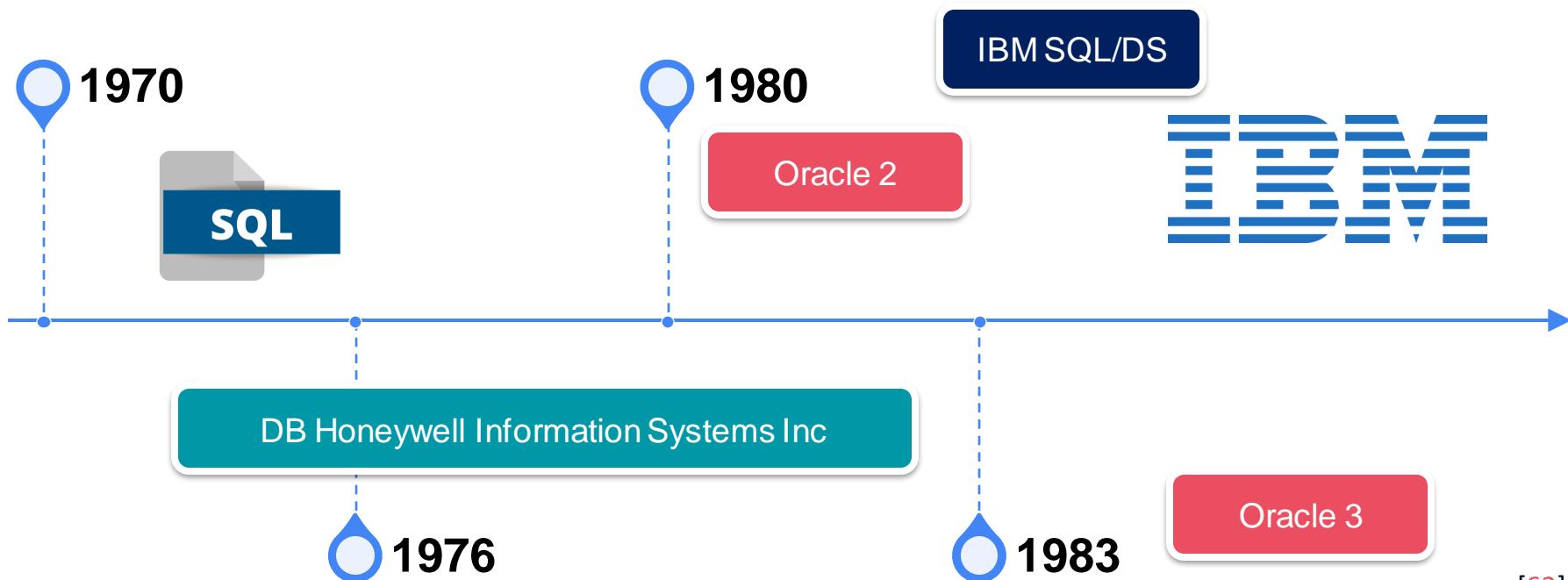
Artigo

1970

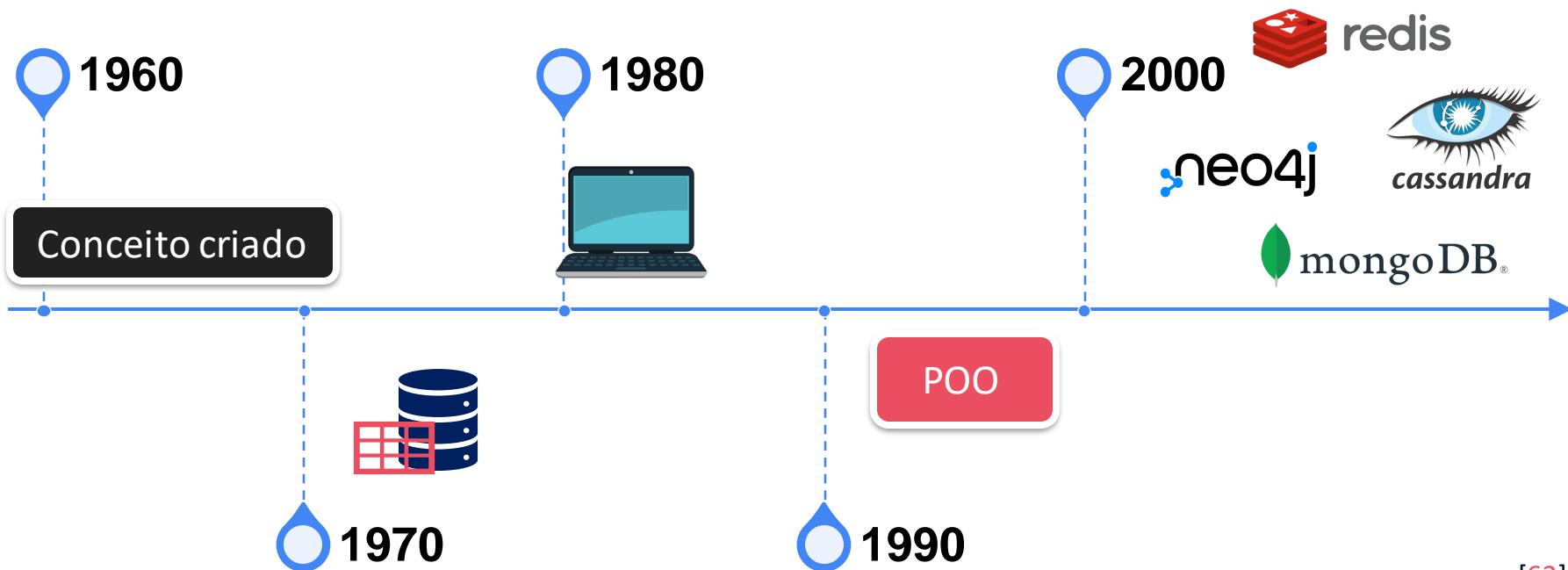
# Breve Histórico



# Sequência de Eventos



# Linha do Tempo



# Primeiros do Mercado

Uso dos pcs



Evolução do modelo relacional - 80's

Feedback

Sistemas distribuídos

Desenvolvimento dos sistemas

8 MB

TeraBytes



1980

# Modelo Hierárquico

Clipper

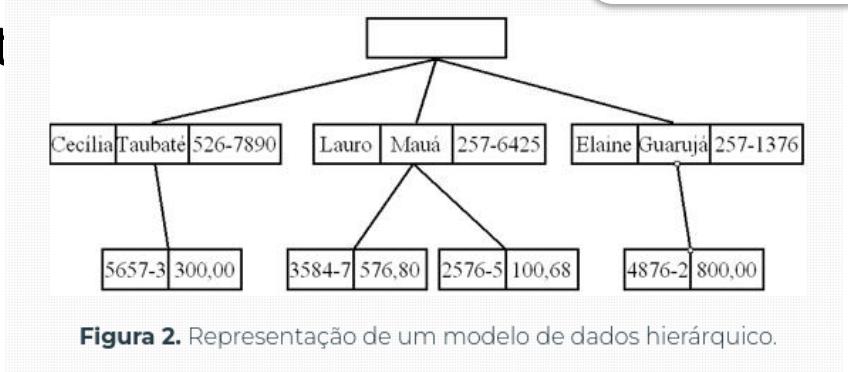
BDDBase

COBOL

Fox Pro

## IMS – Information Management

- Registros: links e dados
- TAD tree – com raiz



**Figura 2.** Representação de um modelo de dados hierárquico.

## Modelo Hierárquico

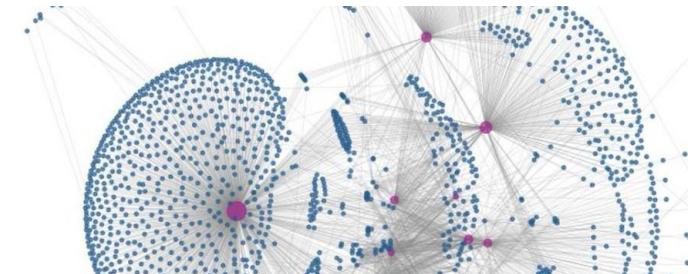
# Modelo em Rede

Relacionamento → N:M

CODASYL

- Links - Ponteiros entre nós
- 1964

Conhecimento da estrutura física do BD



**Figura 1.** Representação de um modelo de dados em rede.

Modelo em rede

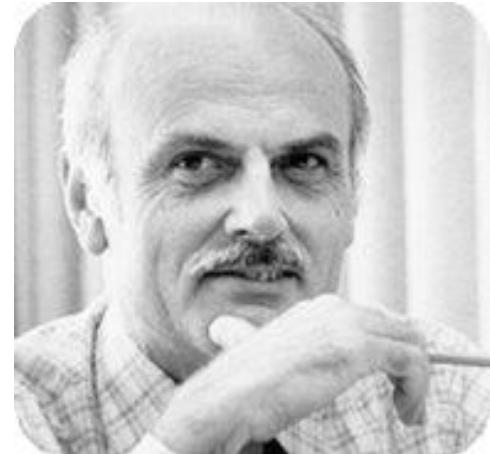
# Modelo de Banco de dados Relacional



# Modelo Relacional

Características

- Álgebra relacional
- Relações
- TAD para armazenamento
- Transparência



1970

Codd, E. F. A relational model for large shared data banks. Communications of the ACM 13(6):377-387, 1970.

Modelo Relacional

# Modelo Relacional

Usuários de BDs



User convencional



Administrador do BD

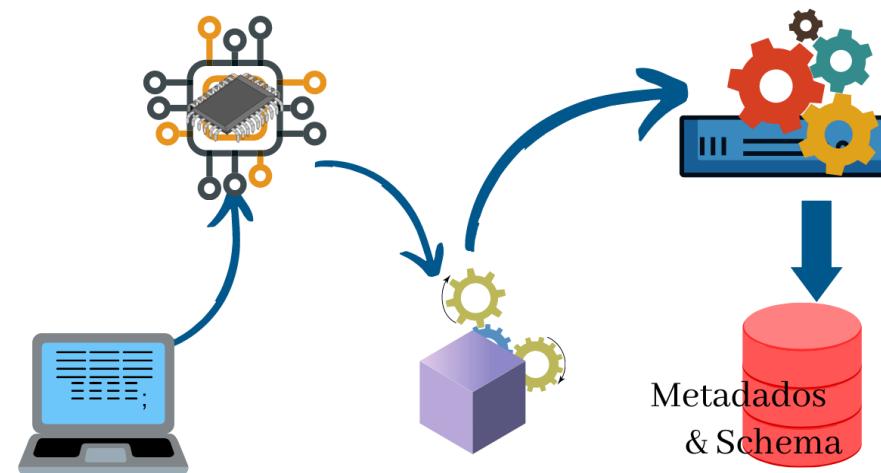
# Modelo Relacional

- Definição das tabelas e constraints para dados
- Comandos traduzidos pelo processador LDD

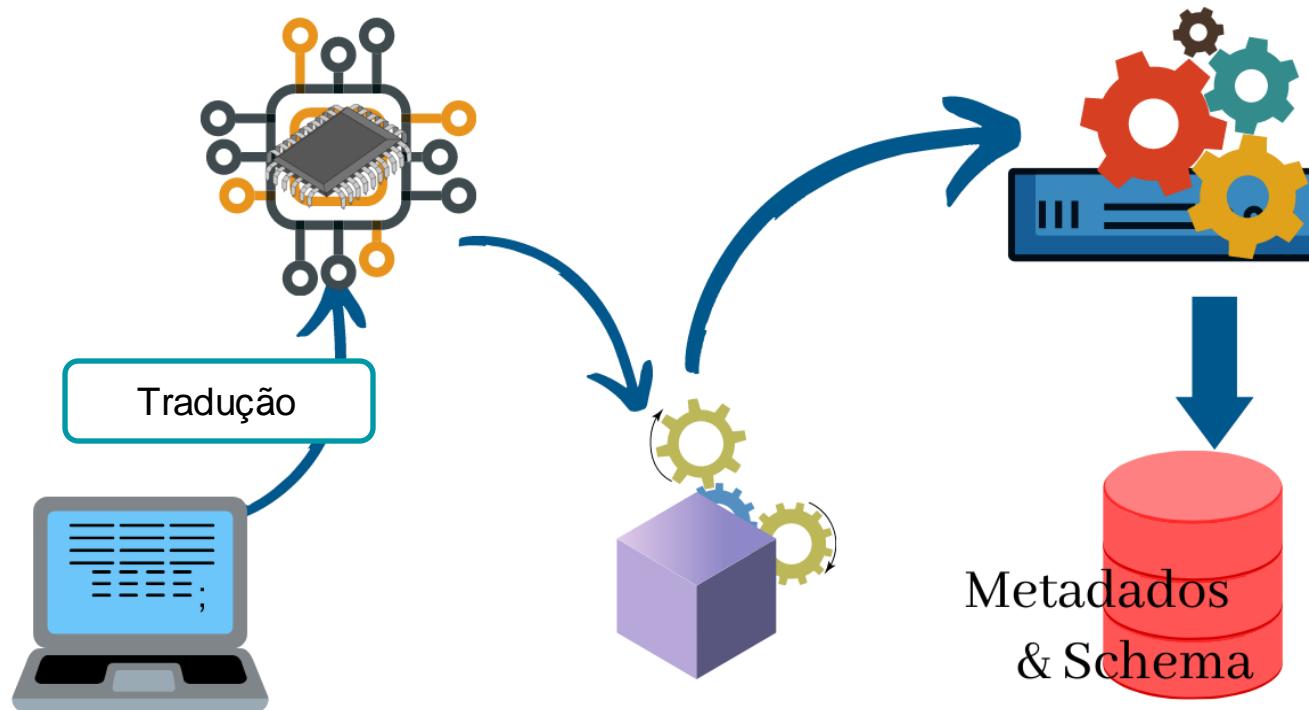


LDD – Linguagem de Definição de Dados

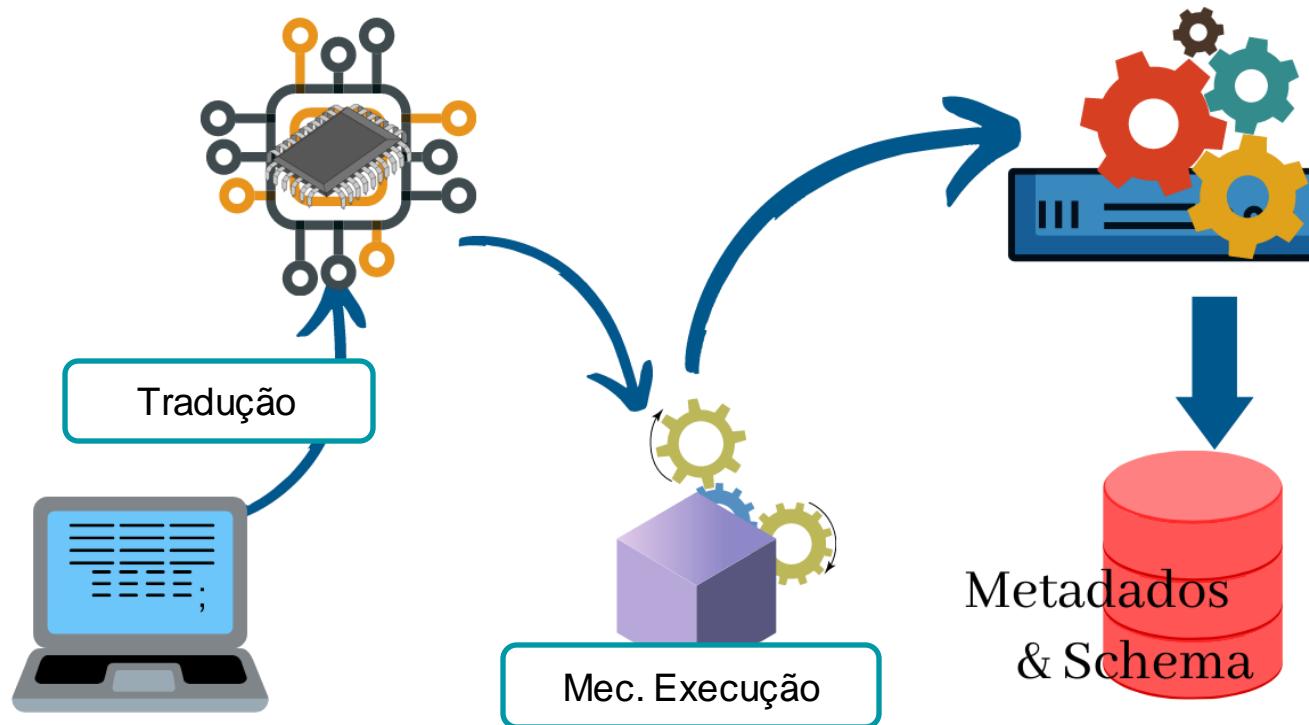
# Modelo Relacional



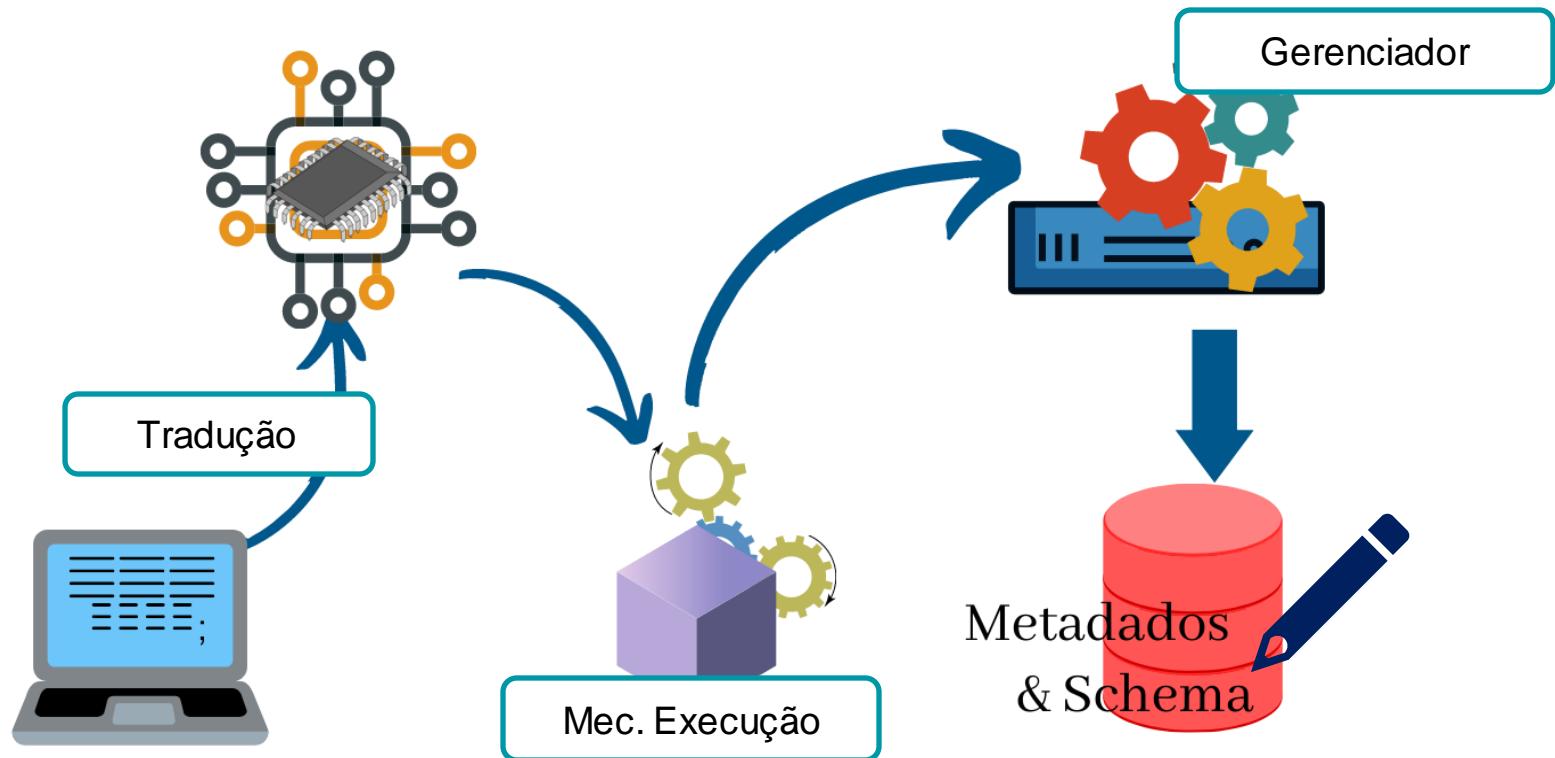
# Modelo Relacional



# Modelo Relacional



# Modelo Relacional



# Modelo Relacional

Características:

- Altera e extrai informações
- Duráveis

Transações



LMD – Linguagem de Definição de Dados

# Modelo Relacional

Características:

- Altera e extrai informações
- Duráveis

Agrupar para executar

Transações

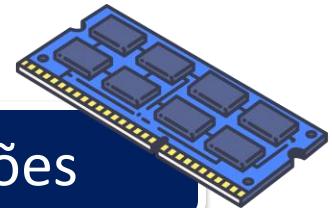


LMD – Linguagem de Definição de Dados

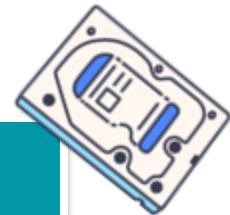
# Storage & Buffer

- Gerenciador de armazenamento
- Gerenciador de buffer

Ações



Dados



LMD – Linguagem de Definição de Dados

# Storage & Buffer

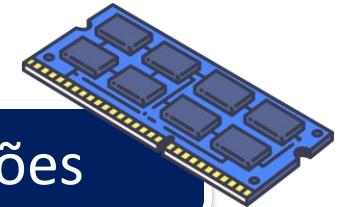
Movimento

- Gerenciador de armazenamento

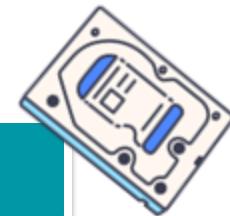
Troca

- Gerenciador de buffer

Ações

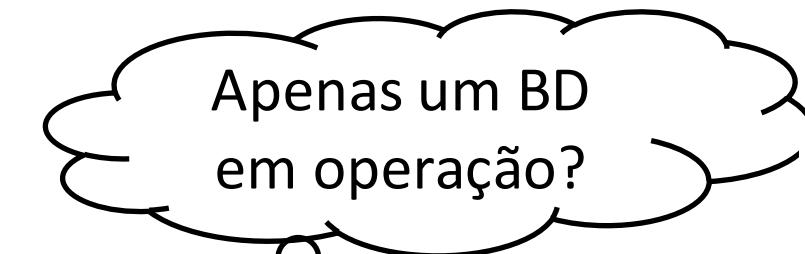


Dados

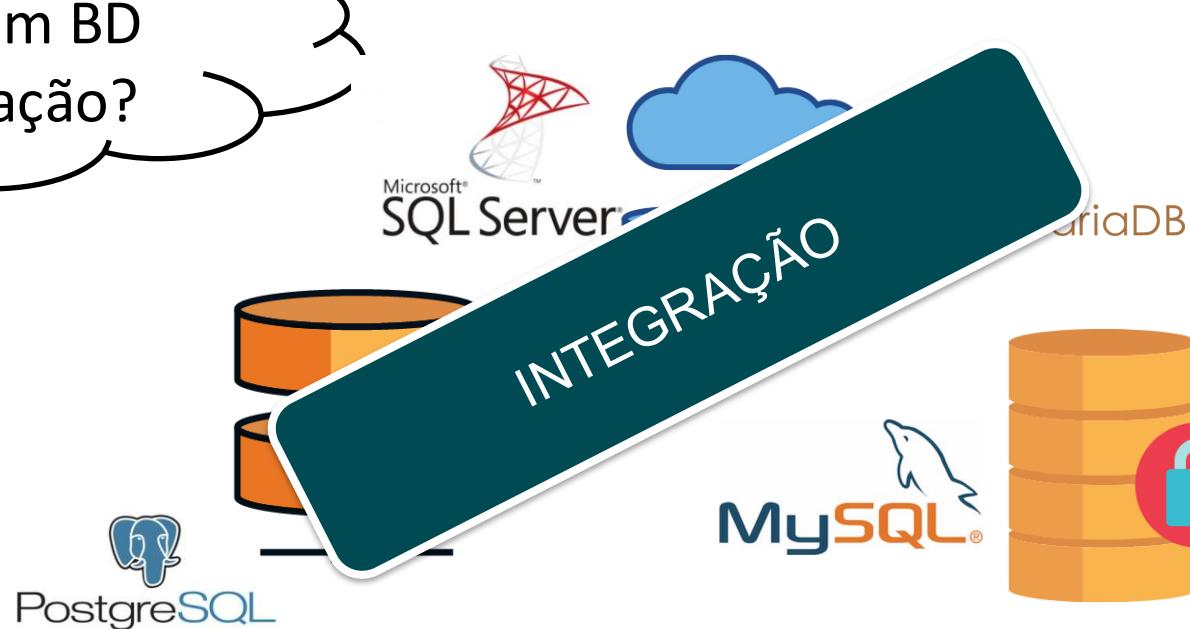
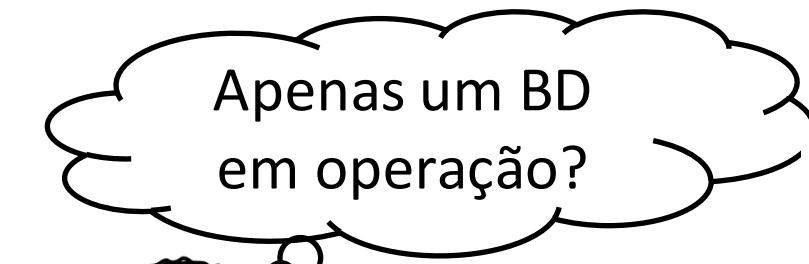


LMD – Linguagem de Definição de Dados

# Cenário



# Cenário



# Cenário



Data warehouses

- Repositórios centralizados
- Mediadores



Middleware



Robertson, T., et al. (2014). The GBIF Integrated Publishing Toolkit: Facilitating the Efficient Publishing of Biodiversity Data on the Internet. PLoS ONE, 9(8), e102623.

# SGBDs utilizados pelo mercado



# Mais utilizados pelo mercado

1

ORACLE®



2

3

Microsoft®  
SQL Server®

T-SQL

4



PostgreSQL



mongoDB®

5



redis

6

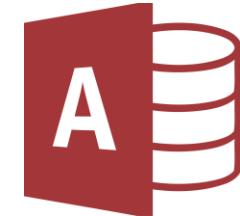
<https://db-engines.com/en/ranking>

# Mais utilizados pelo mercado



ElasticSearch

7



9

12



MariaDB



cassandra

11

# Mais utilizados pelo mercado

Popularidade

Tempo de marcado

Documentação

Robustez

Confiabilidade

Segurança

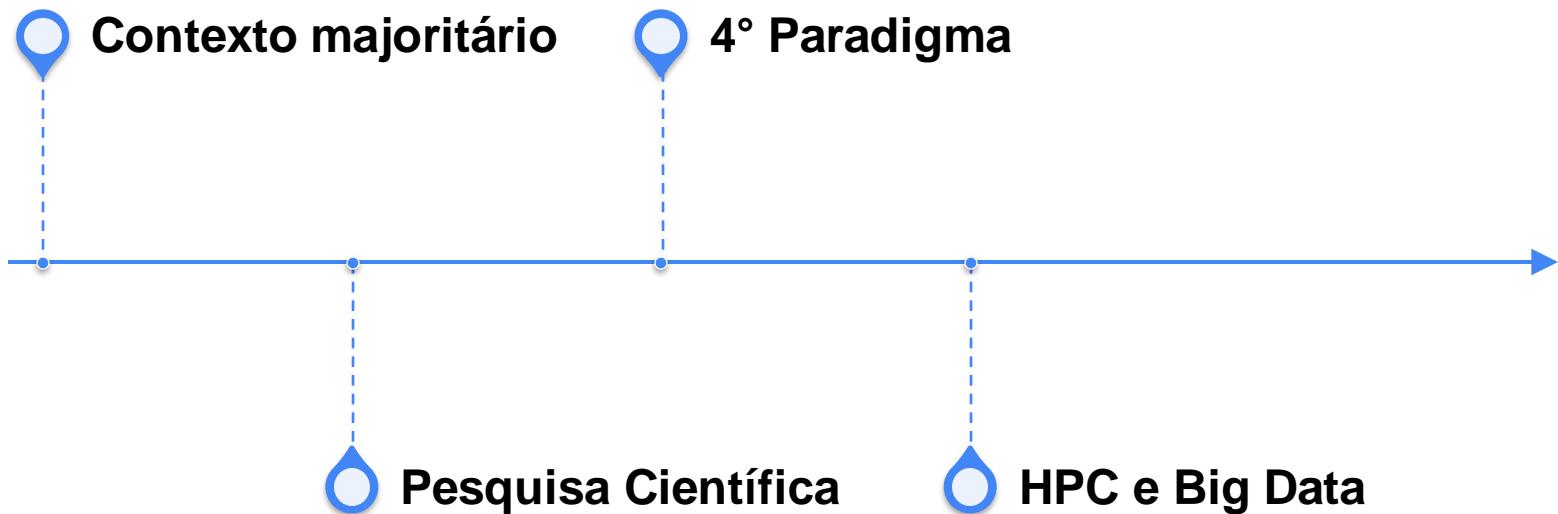
Multiplataforma

## Etapa 3

# A era dos dados e o futuro da modelagem

// Introdução à Banco e dados

# Conversa



# Contexto dos dados

- Papel central – Sistemas Corporativos

MIN/MAX

COUNT

MÉDIA

SOMA

Maioria dos cenários



# Researching



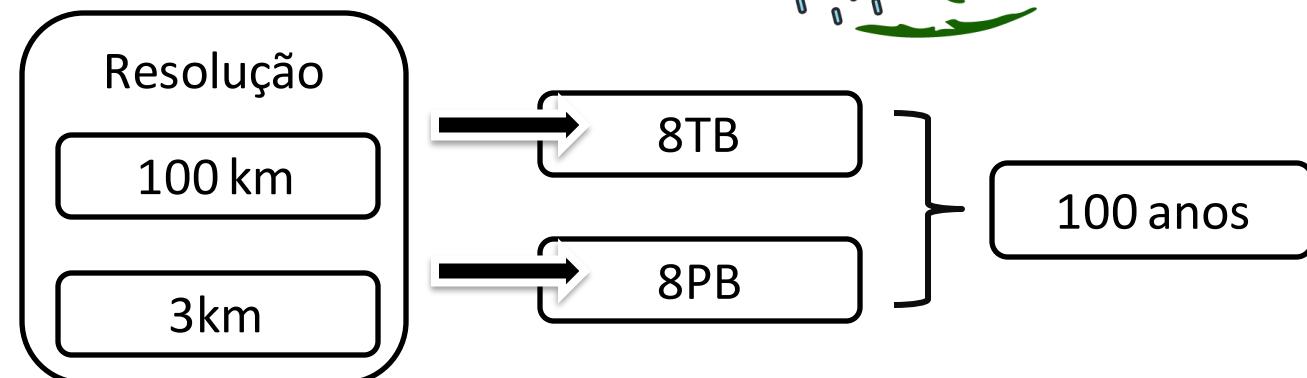
# Researching



- N° de tarefas computacionais
- Quantidade de dados
- Heterogeneidade
- Computação paralela e distribuída

# Researching

Exemplos

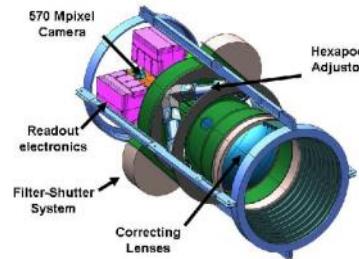


# Researching

## Exemplos



Fonte: Dark Energy Survey (<http://www.darkenergysurvey.org>)

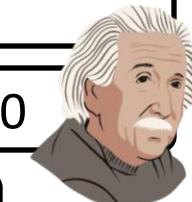


Mapeamento de galáxias,  
supernovas e padrões

6.6TB/dia

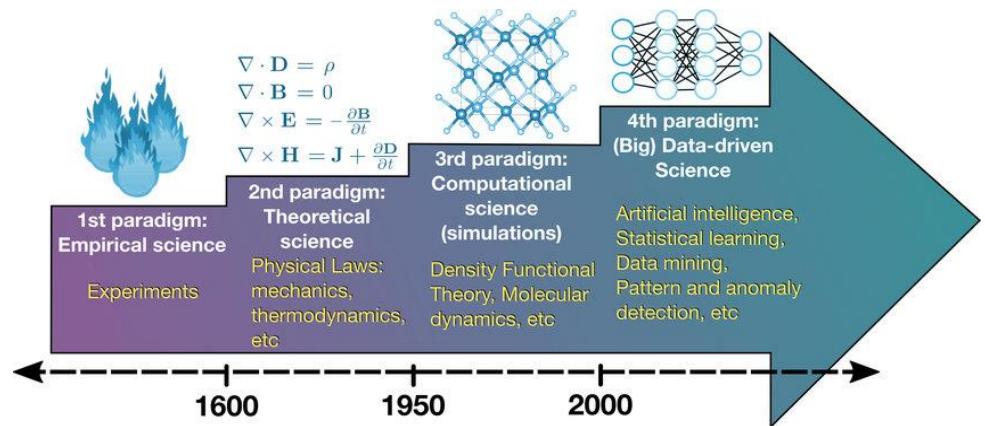
400

25 instituições



# 4º Paradigma

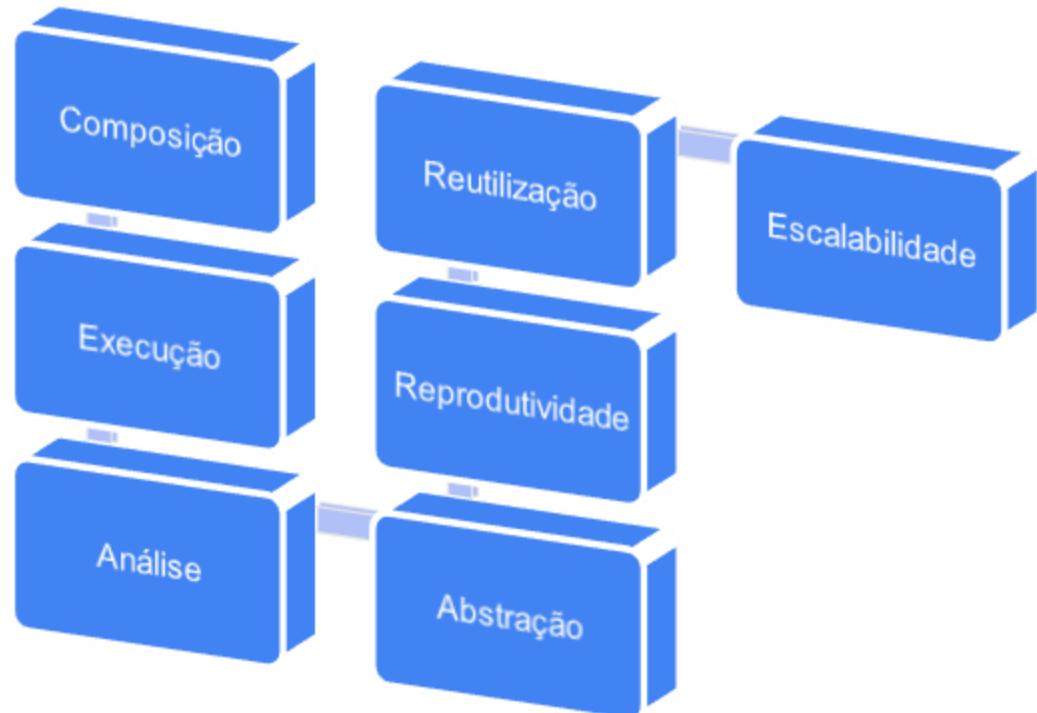
Instrumentos e simulações que geram grande volume de dados



Novo modelo: base na análise e exploração de dados (e-Ciência)

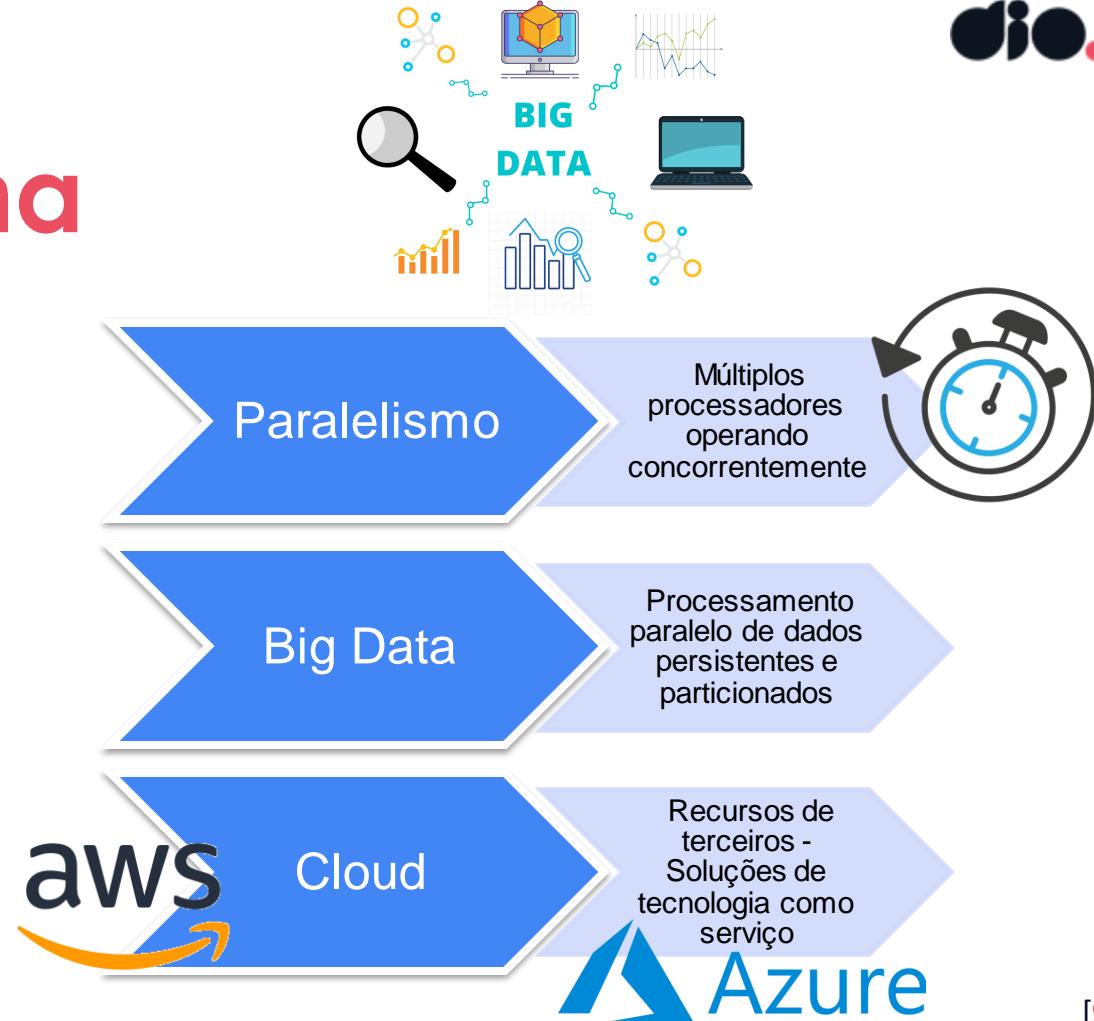
Modelo anterior: empírico, teórico e computacional

# 4º Paradigma

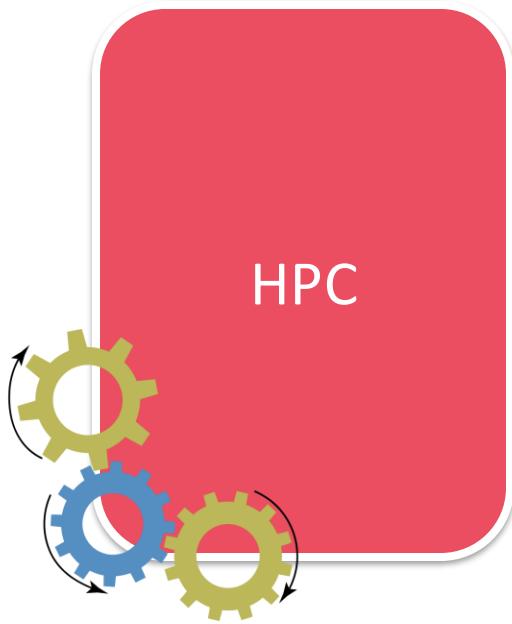


# 4º Paradigma

Experimentos  
realizados em larga  
escala

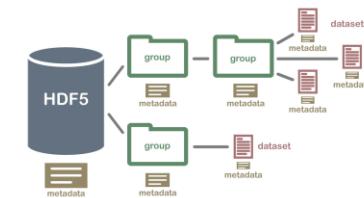


# High Performance Computing



- Nós de processamento
- Sistema de arquivos paralelos – sem persistência
- Modelos: MPI, OpenMP, OpenCL
- Acesso: HFF5 e NetCDF

lustre™



# Big Data



- Process e Storage: nós de processamento
- Sistema de arquivos paralelos – persistente
- Modelos: MapReduce, Spark, SGBDs paralelos

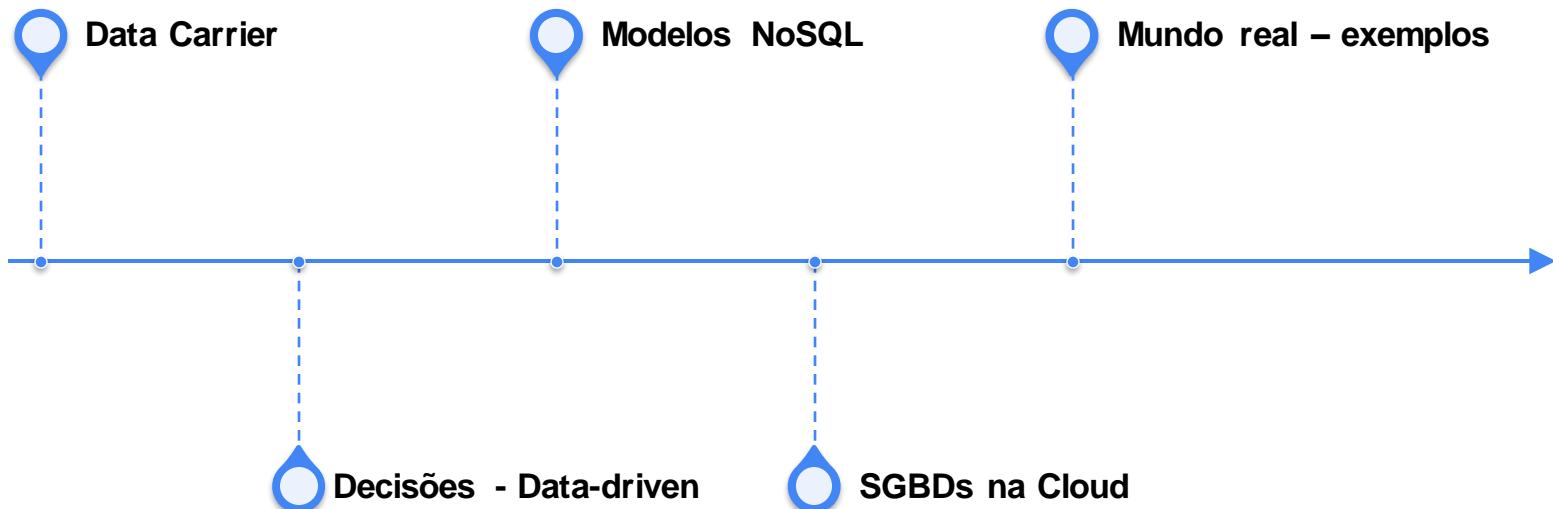


## Etapa 4

# Novo cenário e novas tecnologias - E agora?

// Introdução à Banco e dados

# Conversa



# Novo cenário



- Carreira Tech em Data
- Data-driven
- Novos modelos de SGBDs

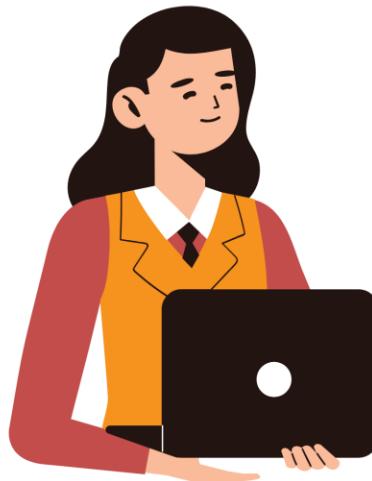


# Mercado de data



Perfil de profissional em data

# Mercado de data



## Engenheiro de dados

- Desenho/Construção/
- Sustentação das soluções de dados

Extração de dados de fontes heterogêneas  
Disponibilizar os dados para serem  
consumidos pelos analistas e cientistas

Engenheiro de dados

# Mercado de data



## Cientista de dados

- Modelagem
- Reconhecimento de padrões / Predição

Busca responder perguntas atreladas ao contexto do negócio. Buscando insights através de técnicas de modelagem

Cientista de dados

# Mercado de data

## Analista de dados

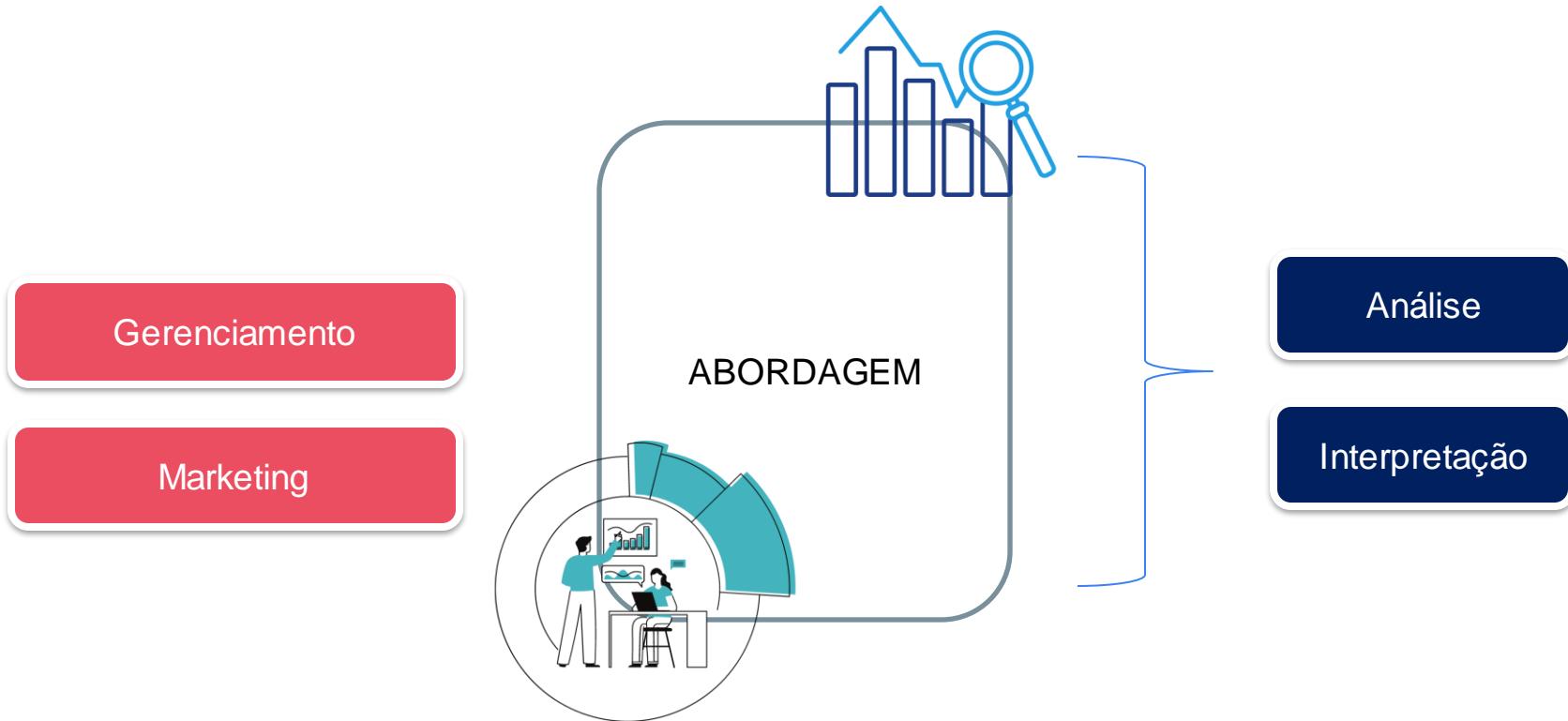


- Criação de dashboards
- Apresentação visual dos dados

Busca entender o comportamento do negócio a partir dos dados. Realiza o diagnóstico, identifica possíveis motivos para comportamentos e verifica métricas

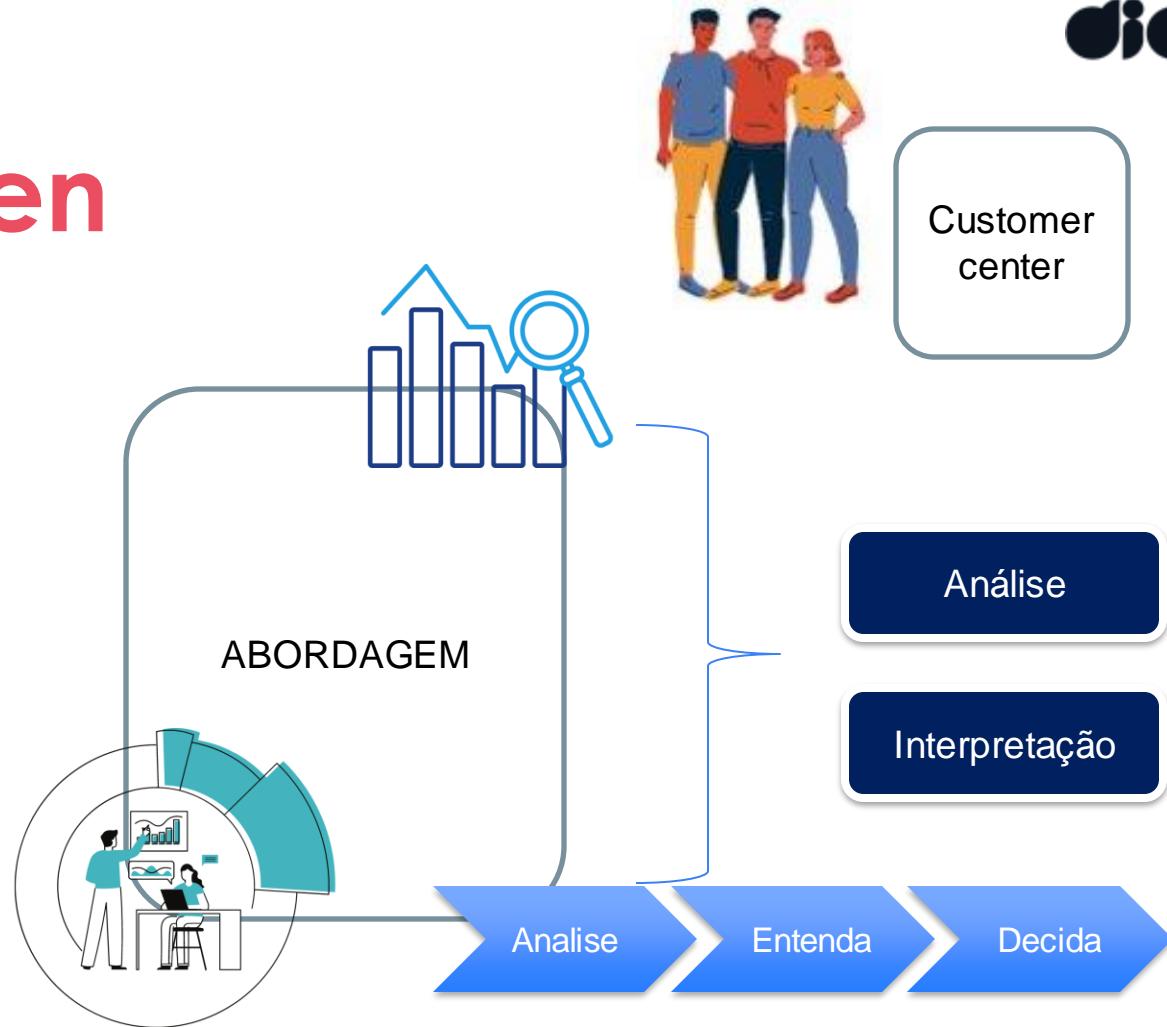
Analista de dados

# Data-driven



# Data-driven

- Área estratégica
- Gerenciamento
- Marketing



# Modelos NoSQL

## SGBDs NoSQL

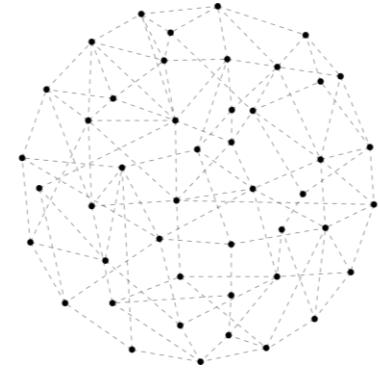
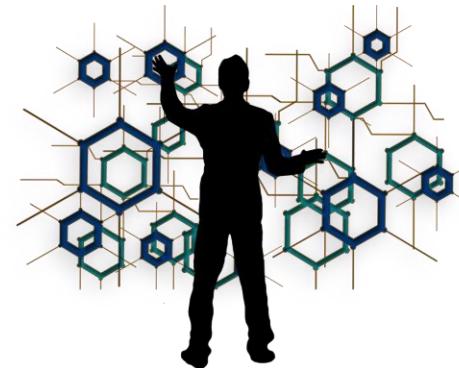
Documentos

Wide-columns

Key-Value

Grafos

Orientado à Objetos



# Modelos NoSQL

## SGBDs NoSQL

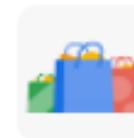
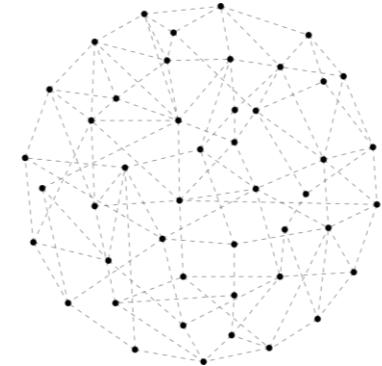
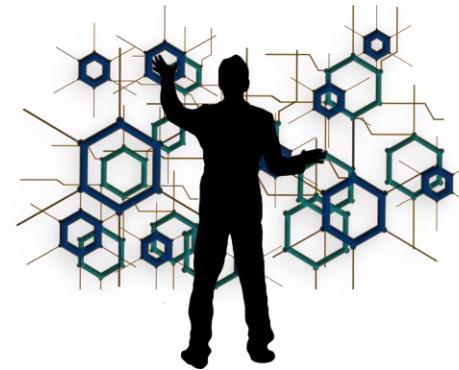
Documentos

Wide-columns

Key-Value

Grafos

Orientado à Objetos



Black Friday

Friday, November 25, 2022

⋮



# Modelos NoSQL

## SGBDs NoSQL

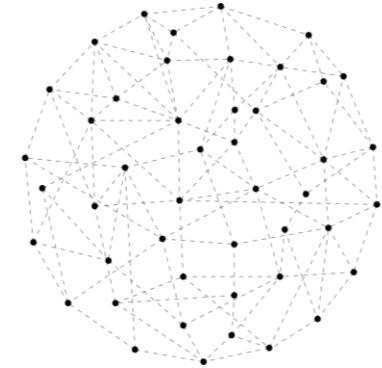
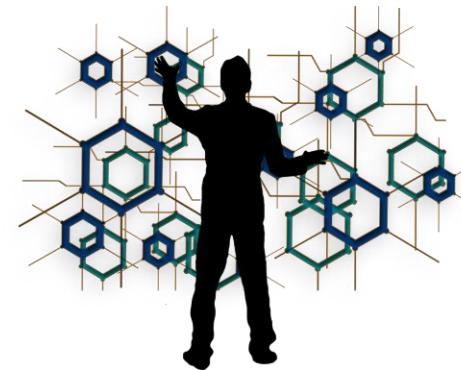
Documentos

Wide-columns

Key-Value

Grafos

Orientado à Objetos



NoSQL

Not only SQL



# Modelos NoSQL

SGBDs NoSQL

Documentos

Wide-columns

Key-Value

Grafos

Orientado à Objetos



## Orientado à Documentos

- Baixa curva de aprendizado
- Baseado em JSON
- Escalabilidade horizontal
- Multi-plataforma
- Transações ACID para multi-documento
- Consultas: Suporta javascript

# Modelos NoSQL

## SGBDs NoSQL

Documentos

Wide-columns

Key-Value

Grafos

Orientado à Objetos



## Orientado à Colunas

- Origem: Facebook
- Open-source: 2008
- Performático
- Descentralizado
- Consultas: CQL



# Modelos NoSQL

## SGBDs NoSQL

Documentos

Wide-columns

**Key-Value**

Grafos

Orientado à Objetos



## Orientado à Key-Value

- 2009 - Escrito em C
- Compatível c/ outras linguagens
- Performático
- Support: strings, lists, maps, sets, JSON, Graphs ...

# Modelos NoSQL

## SGBDs NoSQL

Documentos

Wide-columns

Key-Value

Grafos

Orientado à Objetos



## Orientado à Grafos



- 2007 - escrito em java
- TAD: grafos
- Cypher: query para grafos
- Data science
- Compatível: Python, NodeJS, GO, .NET e Java ...

# Modelos NoSQL

## SGBDs NoSQL

Documentos

Wide-columns

Key-Value

Grafos

Orientado à Objetos



## Orientado à Objetos

- 2008 – open-source
- Escrito em .NET e Java
- Cross-plataform

db4o contains a function to store any object:

```
objectContainer.store(new SomeClass());
```

# DB & Cloud



Amazon **Aurora**



DynamoDB



Amazon **Redshift**



Azure BD



# Mundo Real



PostgreSQL

**ORACLE**  
DATABASE

**NETFLIX**   
**MySQL**

**MySQL**



**ORACLE**  
DATABASE



DB  
DB.io  
Database of  
Databases

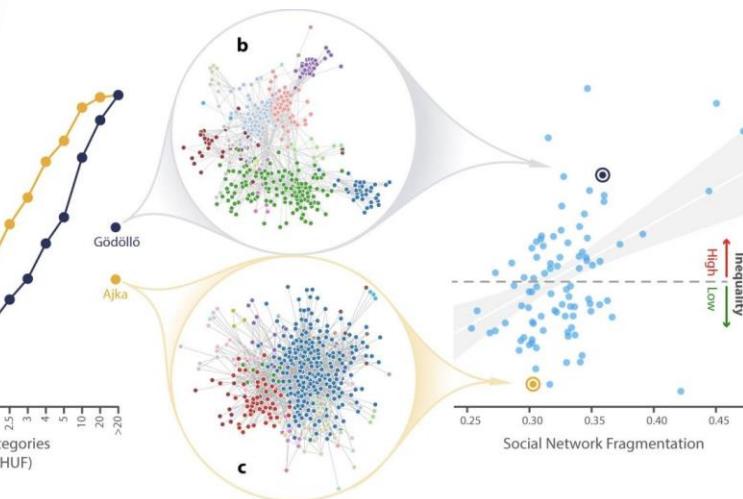
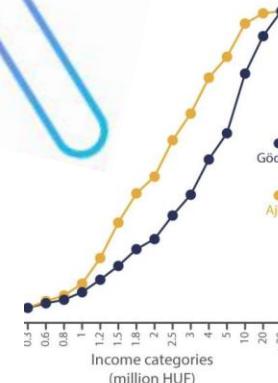


# Mundo Real



## Black Friday

Friday, November 25, 2022

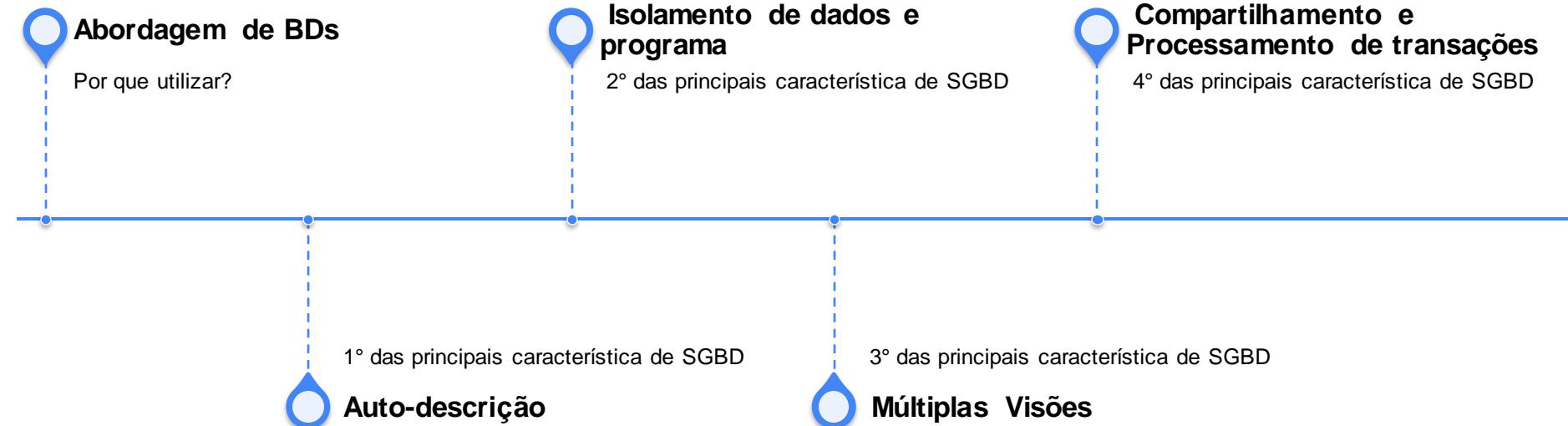


## Etapa 5

# Explorando a abordagem de um SGBD – Isolamento, Auto-descrição, Compartilhamento e Visões

// Introdução à Banco e dados

# Conversa



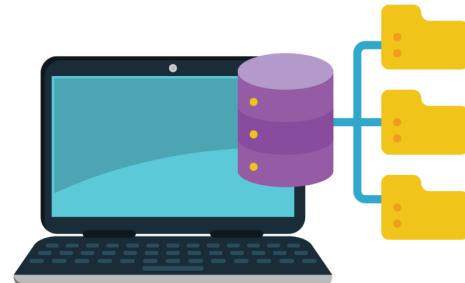
# Abordagem de BD



# Abordagem de BD



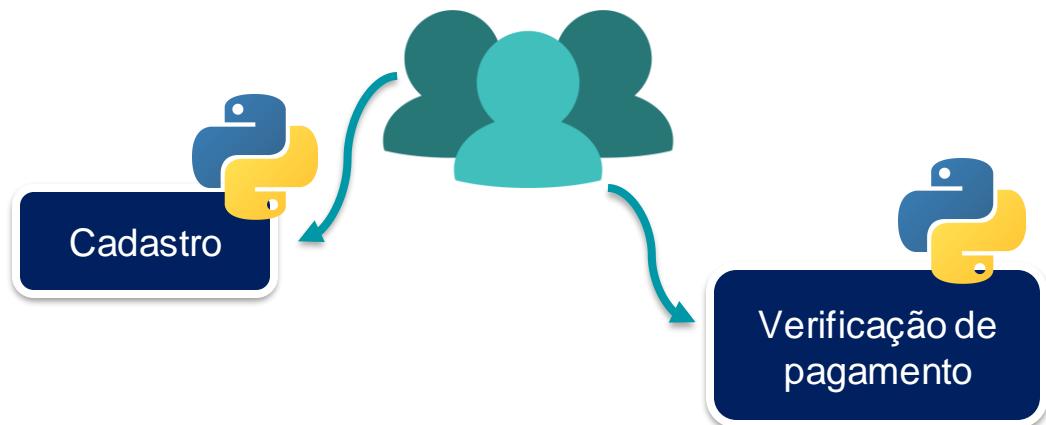
Abordagem tradicional



Abordagem BDs

# Abordagem de BD

Suponha as aplicações



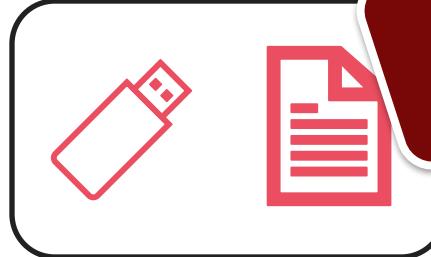
# Abordagem de BD

Suponha as aplicações

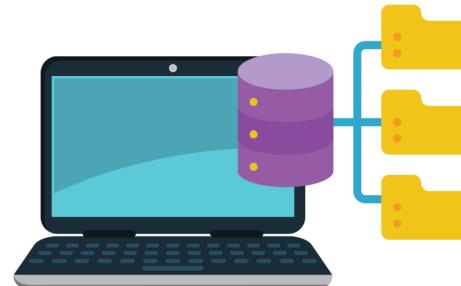
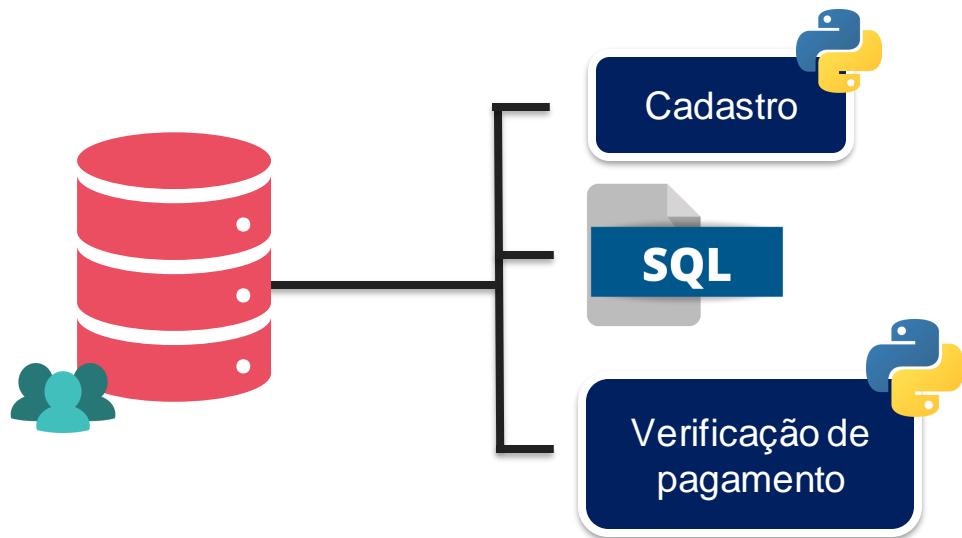


# Abordagem de BD

Suponha as aplicações:



# Abordagem de BD



Abordagem BDs

# Abordagem de BD

Características principais:

Abstração

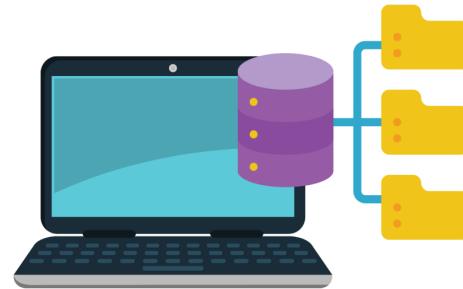
Auto-descrição

Isolamento

Compartilhamento

Múltiplas visões

Transação  
multiuser



Abordagem BDs

# Natureza auto-descritiva da abordage de BD



# Natureza Auto-descritiva



Descrição da estrutura  
e constraints

DB schema



Metadados  
& Schema

# Natureza Auto-descritiva



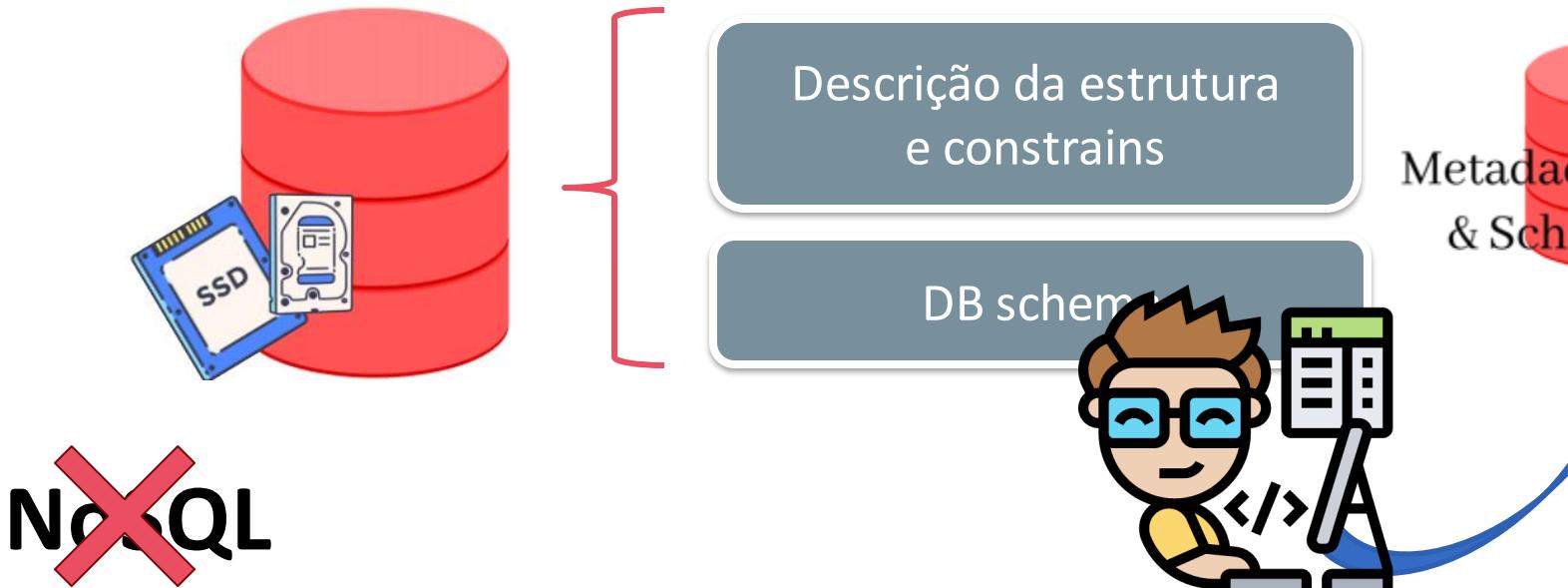
Descrição da estrutura  
e constraints

DB schema



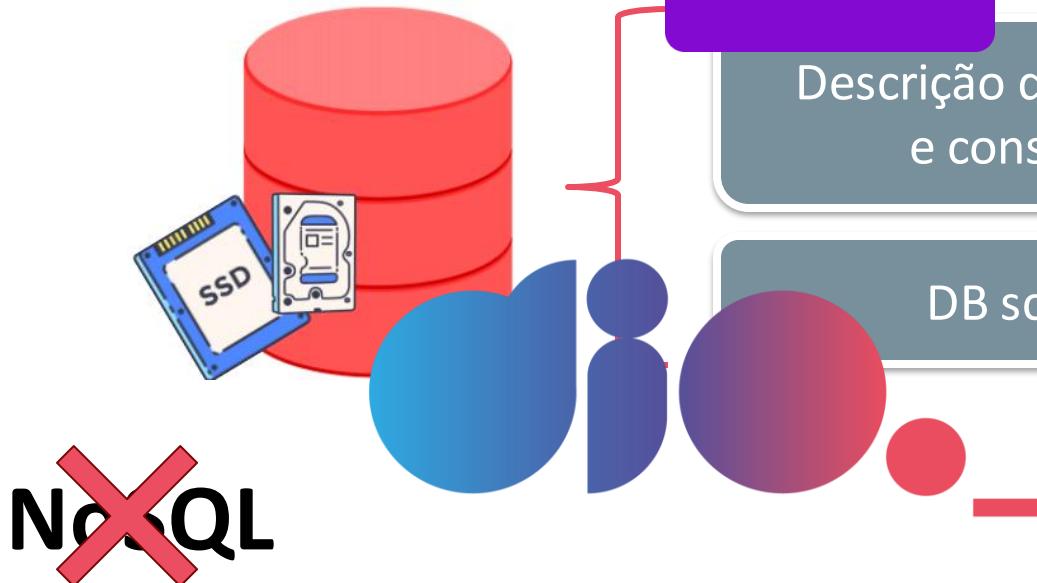
NoSQL

# Natureza Auto-descritiva



# Natureza Autônoma e Criativa

amazon.com.br



NoSQL

Metadados  
& Schema

# Natureza Auto-descritiva



Abordagem tradicional



Programa da Aplicação

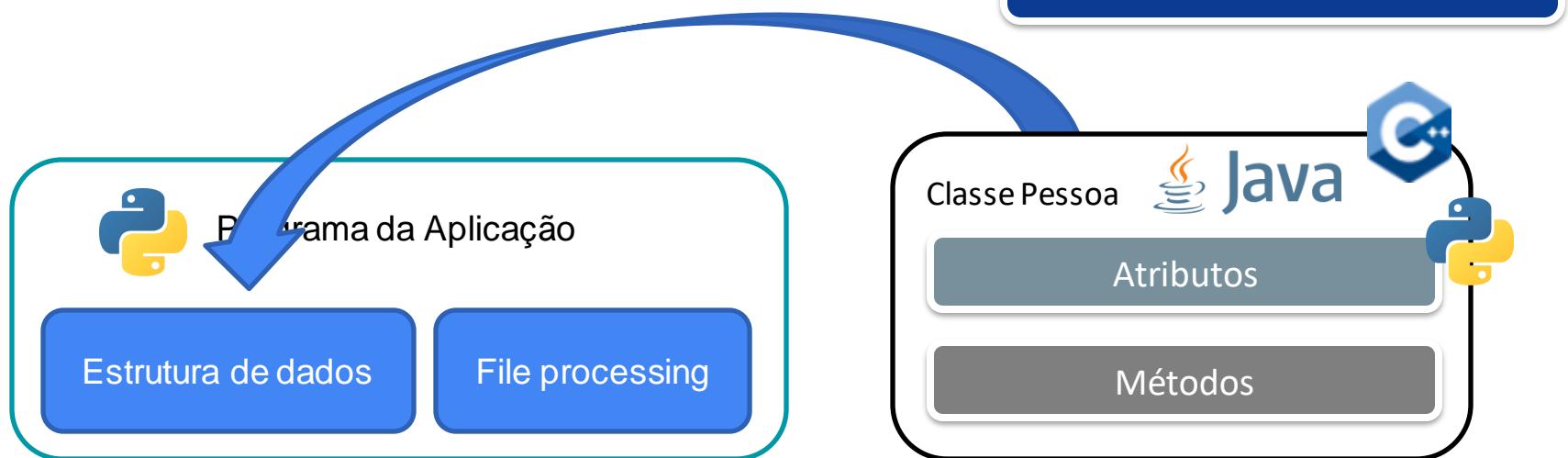
Estrutura de dados

File processing

# Natureza Auto-descritiva



Abordagem tradicional



# Catálogo

## RELATIONS

| Relation_name | No_of_columns |
|---------------|---------------|
| STUDENT       | 4             |
| COURSE        | 4             |
| SECTION       | 5             |
| GRADE_REPORT  | 3             |
| PREREQUISITE  | 2             |

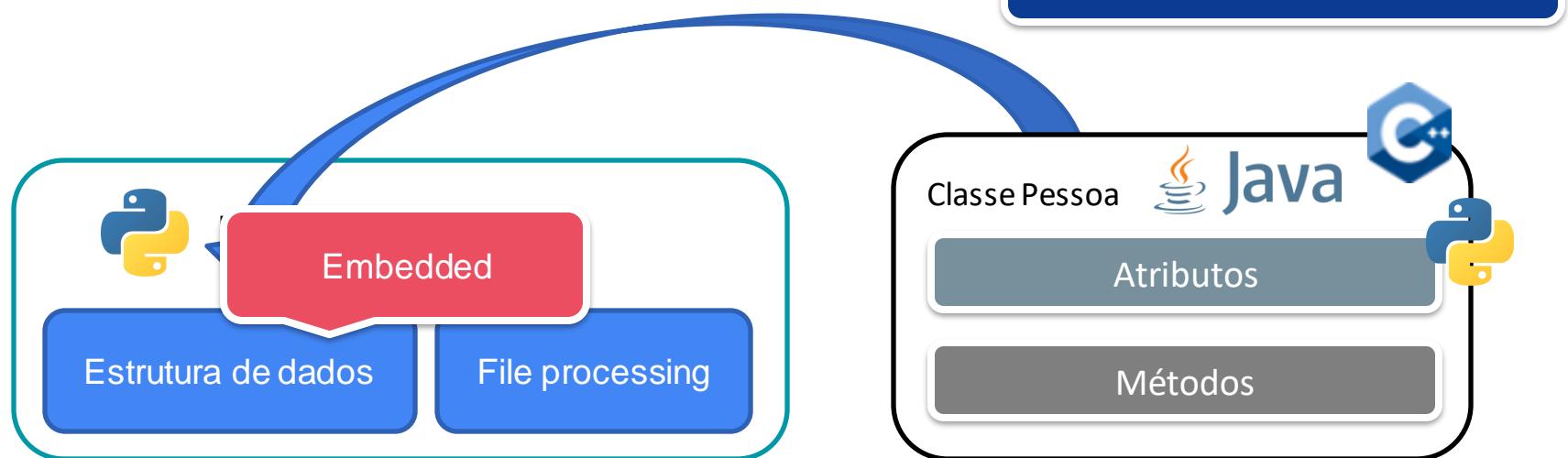
## COLUMNS

| Column_name         | Data_type      | Belongs_to_relation |
|---------------------|----------------|---------------------|
| Name                | Character (30) | STUDENT             |
| Student_number      | Character (4)  | STUDENT             |
| Class               | Integer (1)    | STUDENT             |
| Major               | Major_type     | STUDENT             |
| Course_name         | Character (10) | COURSE              |
| Course_number       | XXXXNNNN       | COURSE              |
| ....                | ....           | ....                |
| ....                | ....           | ....                |
| ....                | ....           | ....                |
| Prerequisite_number | XXXXNNNN       | PREREQUISITE        |

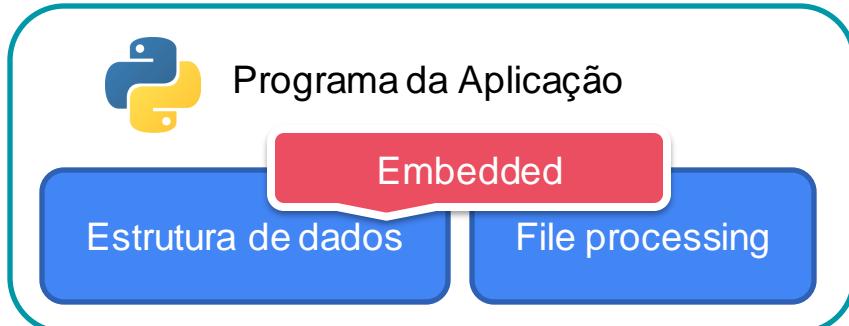
# Isolamento entre Program/Data e Abstração



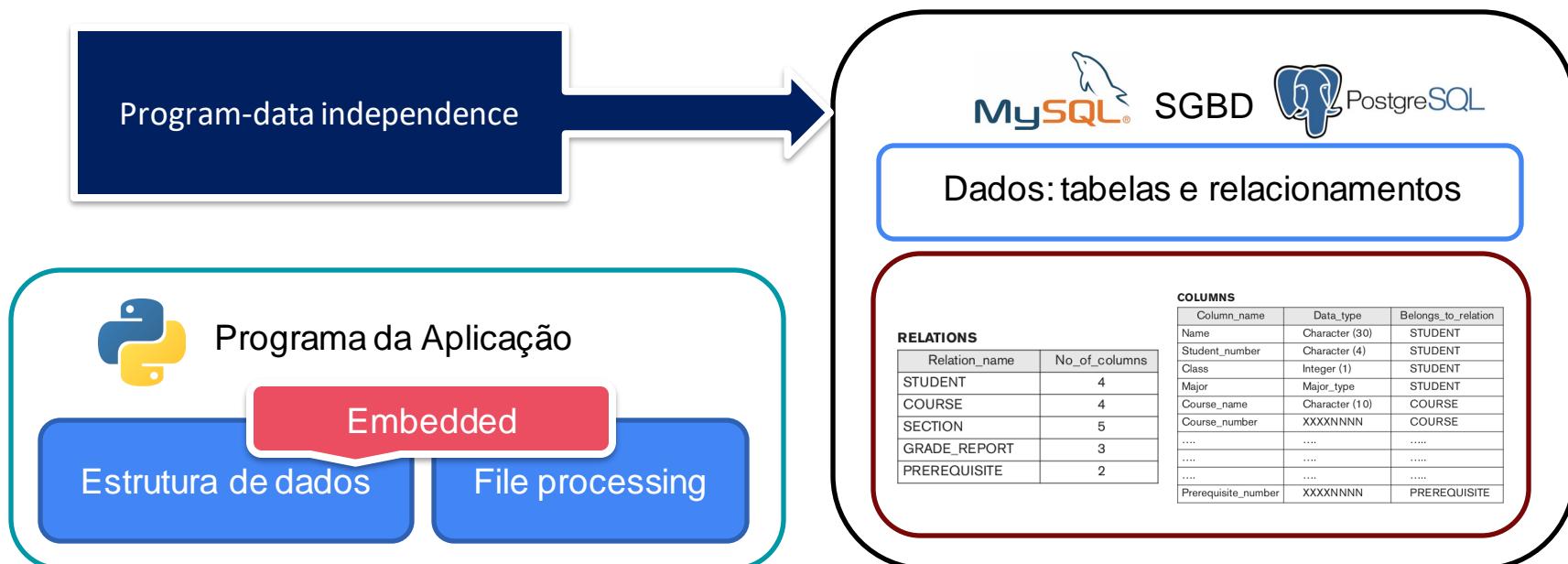
# Isolamento e abstração



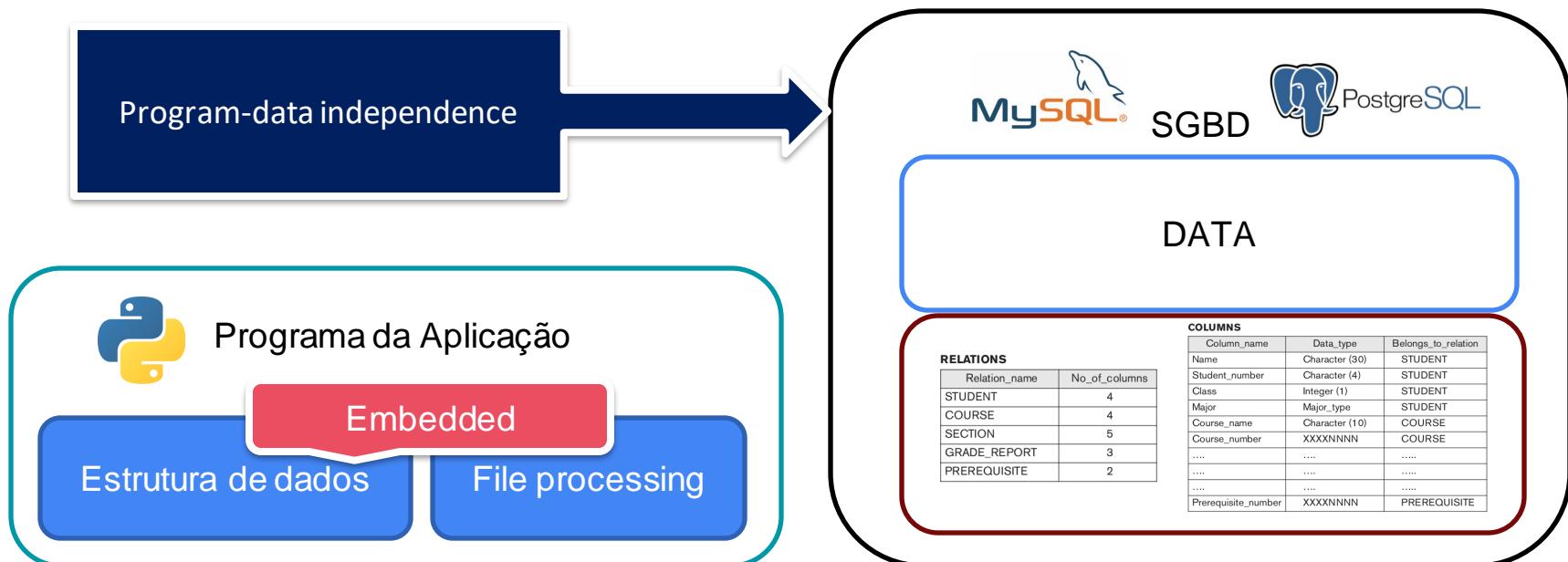
# Isolamento e abstração



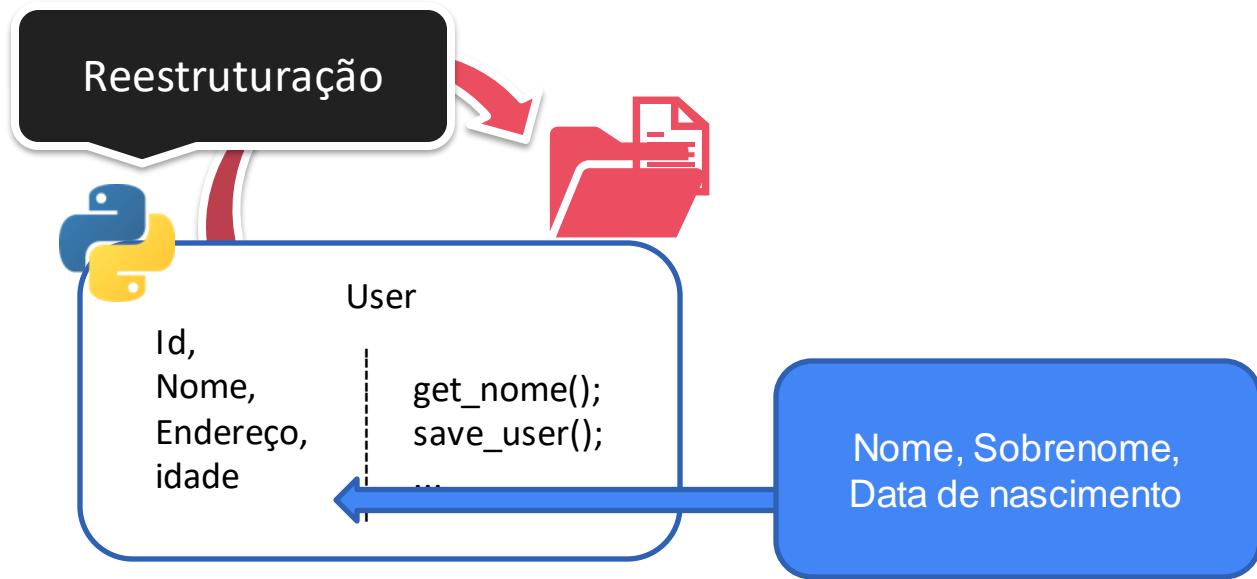
# Isolamento e abstração



# Isolamento e abstração



# Isolamento e abstração



# Isolamento e abstração



# Isolamento e abstração

- Abstração
- Transparência



Independência do  
programa e dados

# Isolamento e abstração

- Abstração
- Transparência



# Isolamento e abstração

| Data Item Name | Starting Position in Record | Length in Characters (bytes) |
|----------------|-----------------------------|------------------------------|
| Name           | 1                           | 30                           |
| Student_number | 31                          | 4                            |
| Class          | 35                          | 1                            |
| Major          | 36                          | 4                            |

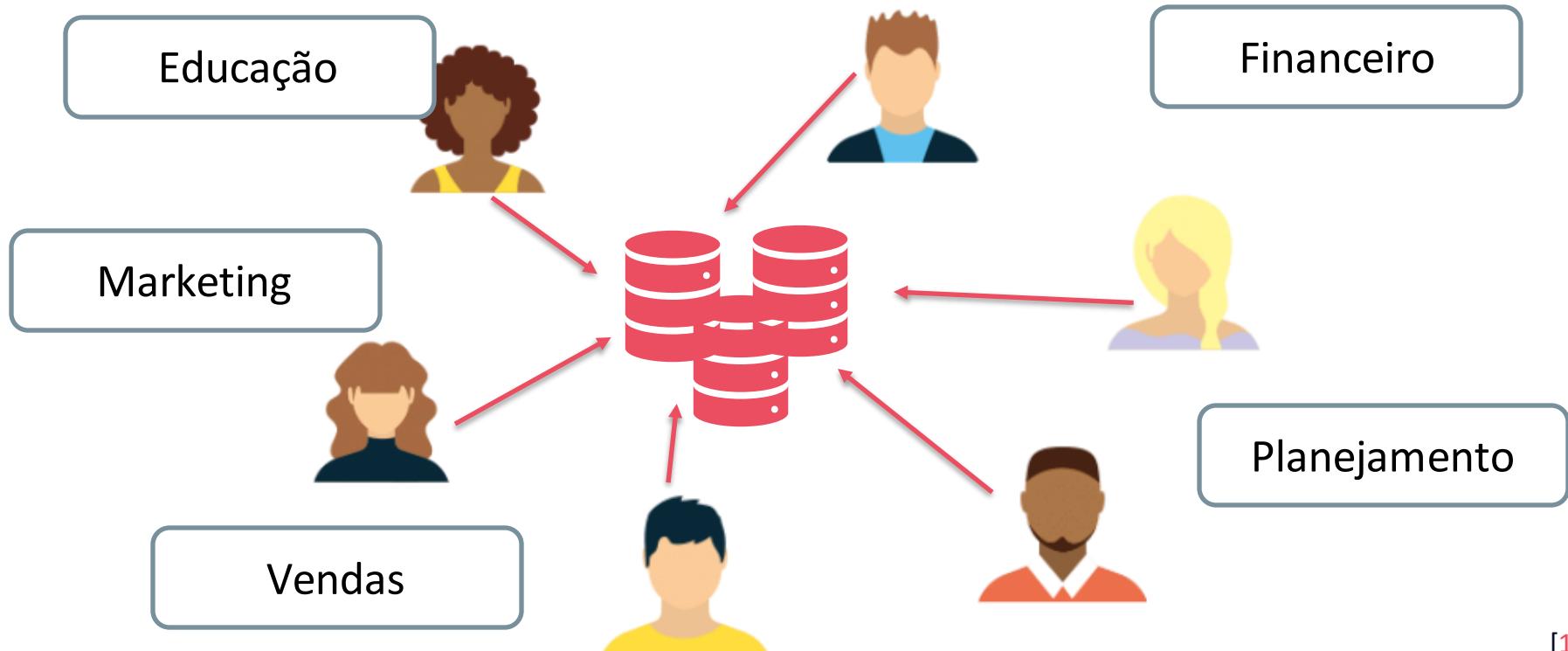


Catálogo

# Suporte a Múltiplas Visões dos dados



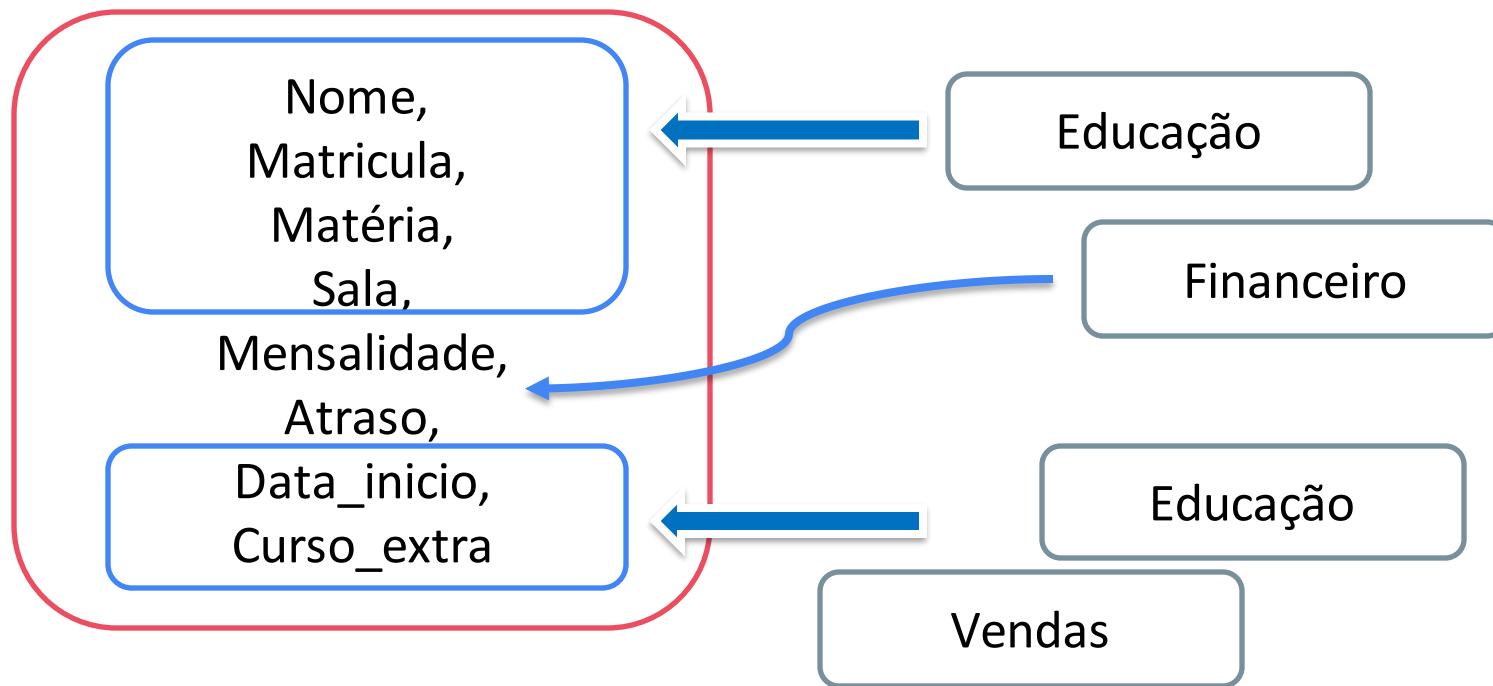
# Table Views



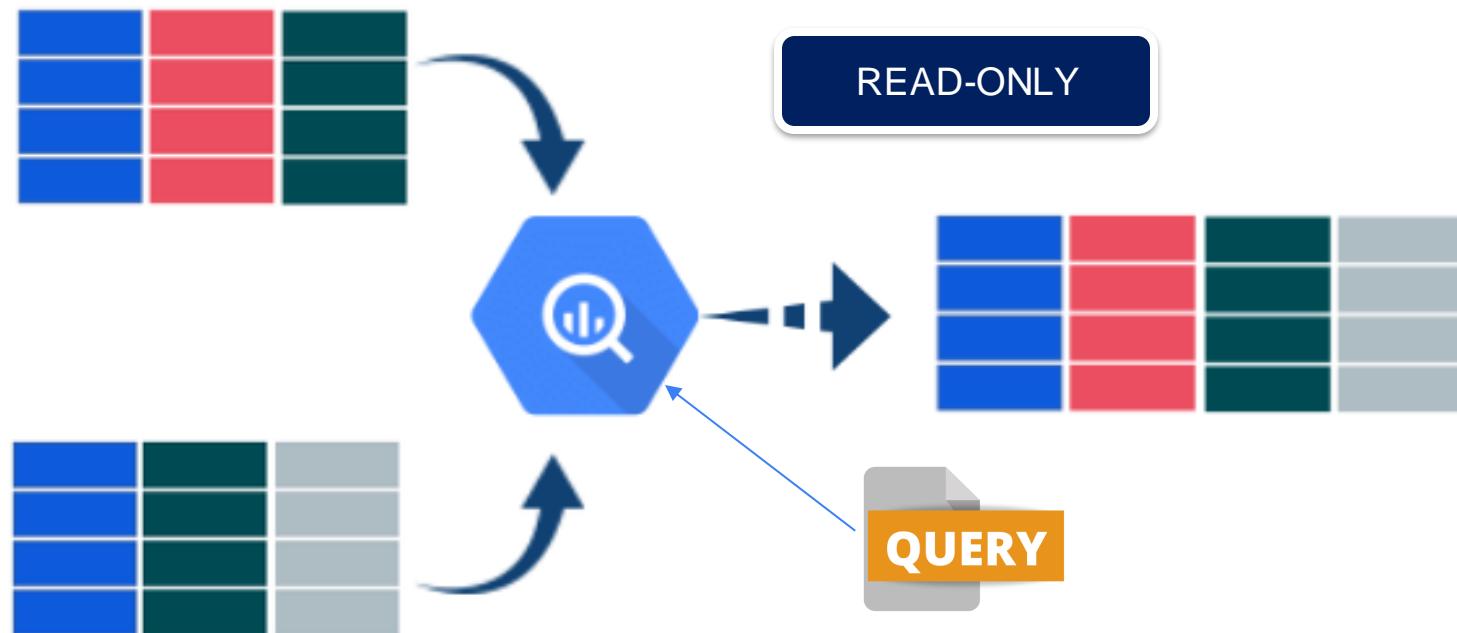
# Table Views



# Table Views



# Table Views



# Table Views

**PREREQUISITE**

| Course_number | Prerequisite_number |
|---------------|---------------------|
| CS3380        | CS3320              |
| CS3380        | MATH2410            |
| CS3320        | CS1310              |

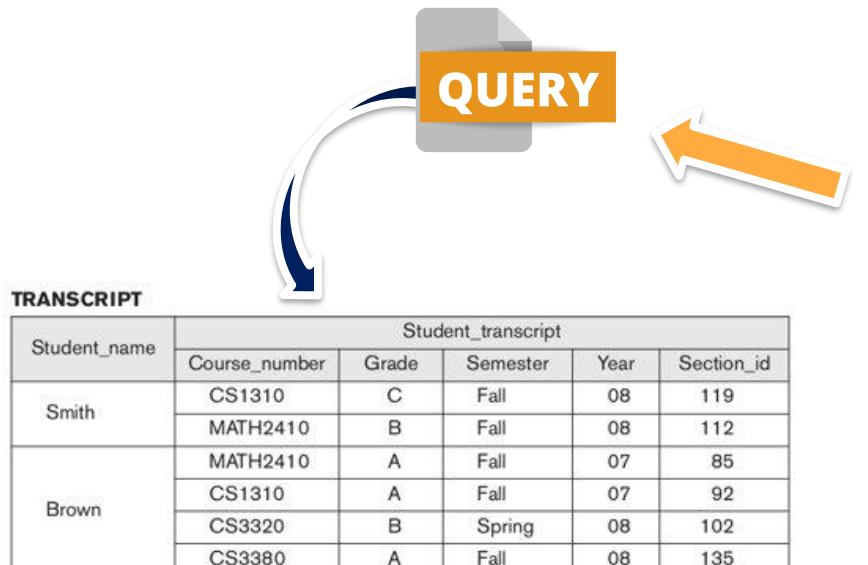
**COURSE**

| Course_name               | Course_number | Credit_hours | Department |
|---------------------------|---------------|--------------|------------|
| Intro to Computer Science | CS1310        | 4            | CS         |
| Data Structures           | CS3320        | 4            | CS         |
| Discrete Mathematics      | MATH2410      | 3            | MATH       |
| Database                  | CS3380        | 3            | CS         |

**COURSE\_PREREQUISITES**

| Course_name     | Course_number | Prerequisites |
|-----------------|---------------|---------------|
| Database        | CS3380        | CS3320        |
|                 |               | MATH2410      |
| Data Structures | CS3320        | CS1310        |

# Table Views



## STUDENT

| Name  | Student_number | Class | Major |
|-------|----------------|-------|-------|
| Smith | 17             | 1     | CS    |
| Brown | 8              | 2     | CS    |

## GRADE\_REPORT

| Student_number | Section_identifier | Grade |
|----------------|--------------------|-------|
| 17             | 112                | B     |
| 17             | 119                | C     |
| 8              | 85                 | A     |
| 8              | 92                 | A     |
| 8              | 102                | B     |
| 8              | 135                | A     |

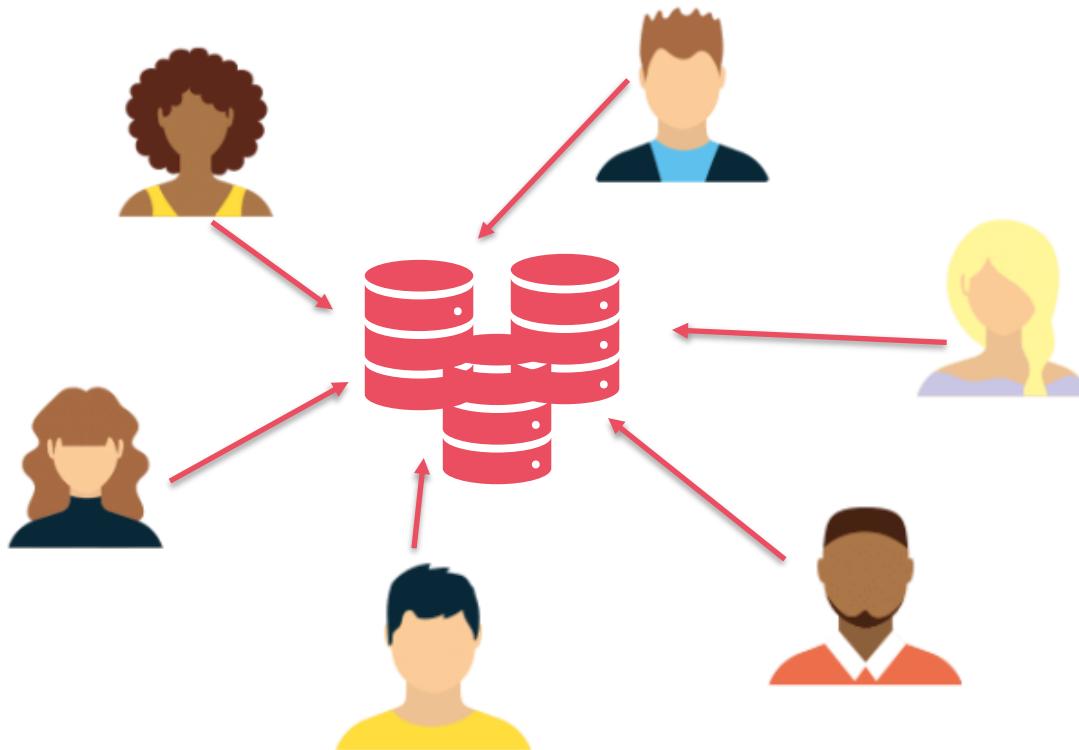
## SECTION

| Section_identifier | Course_number | Semester | Year | Instructor |
|--------------------|---------------|----------|------|------------|
| 85                 | MATH2410      | Fall     | 07   | King       |
| 92                 | CS1310        | Fall     | 07   | Anderson   |
| 102                | CS3320        | Spring   | 08   | Knuth      |
| 112                | MATH2410      | Fall     | 08   | Chang      |
| 119                | CS1310        | Fall     | 08   | Anderson   |
| 135                | CS3380        | Fall     | 08   | Stone      |

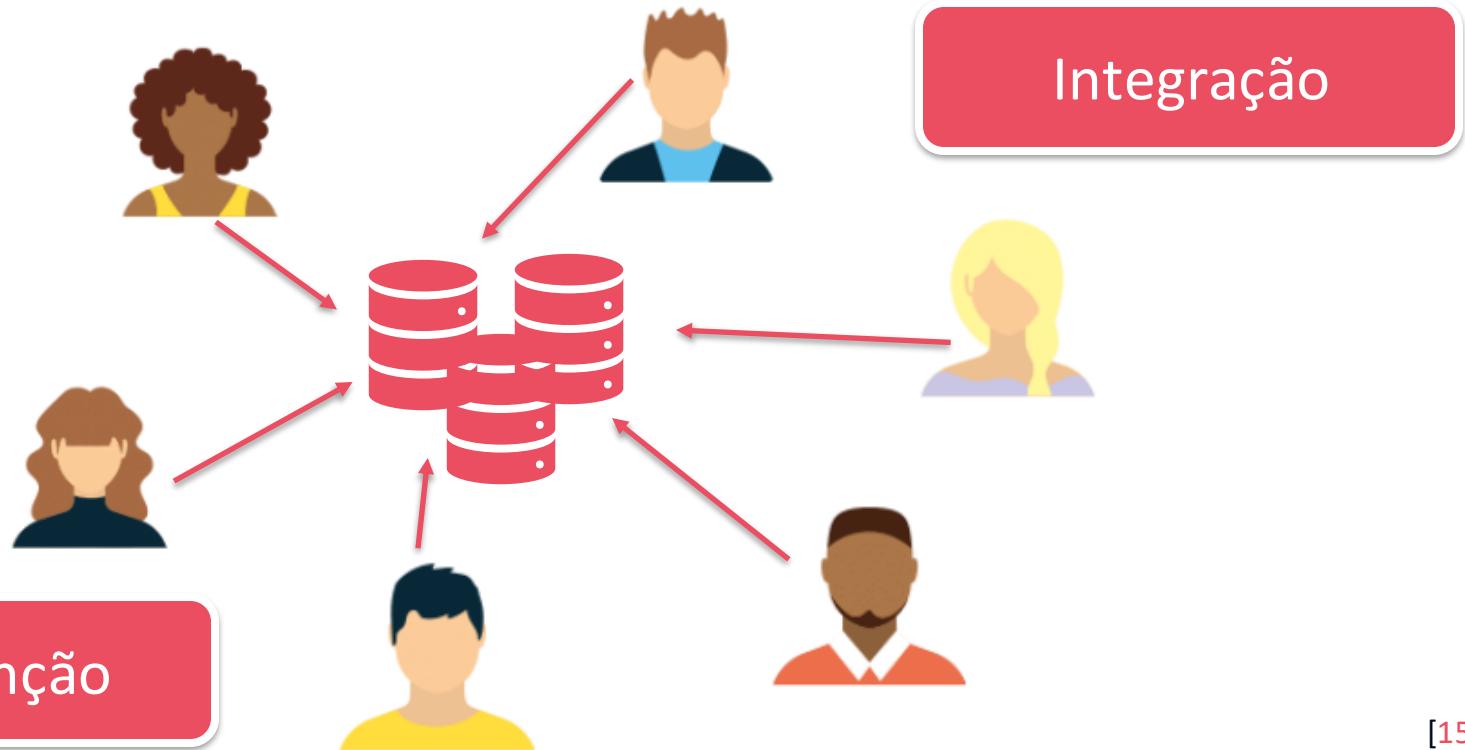
# Compartilhamento de dados e processamento de transações multiusuários



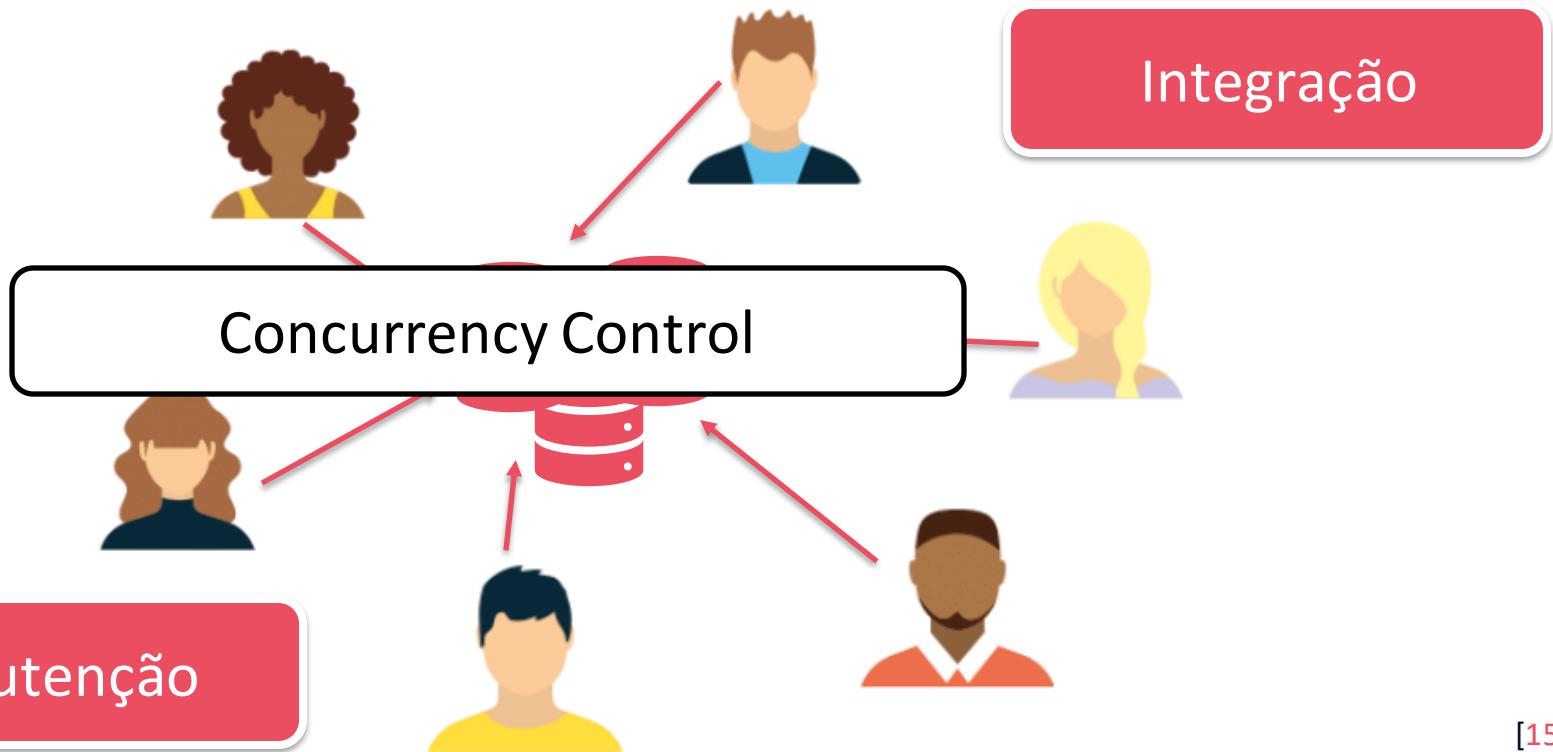
# Design – Múltiplos acessos



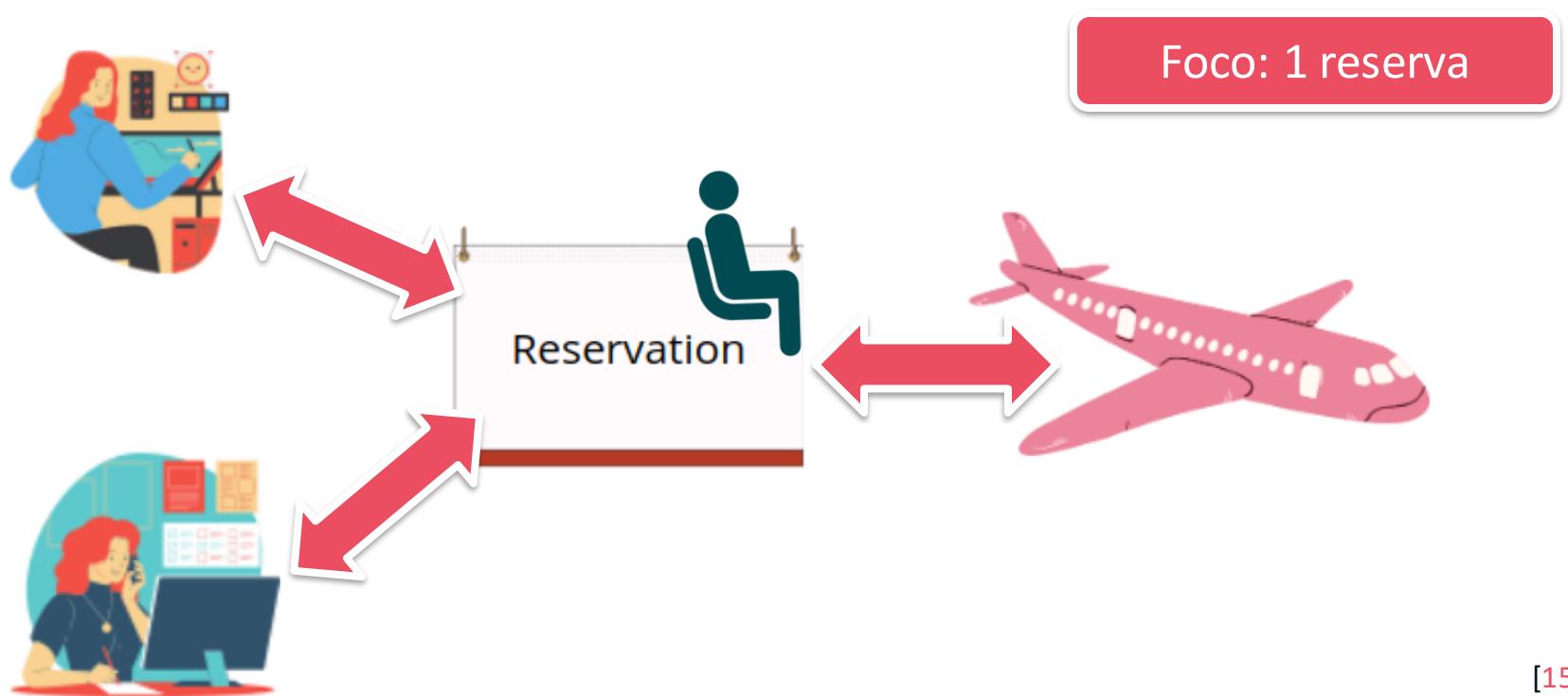
# Design – Múltiplos acessos



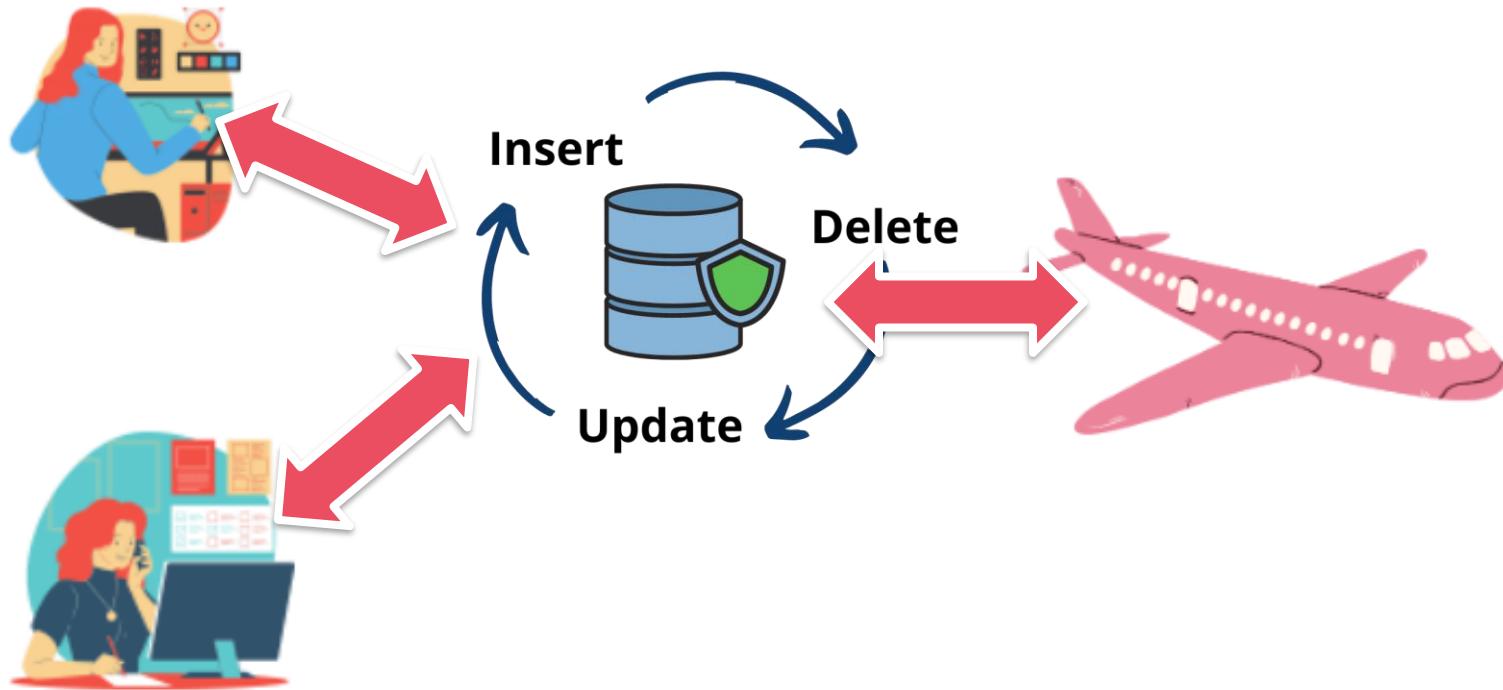
# Concorrência



# Múltiplos acessos



# OLTP



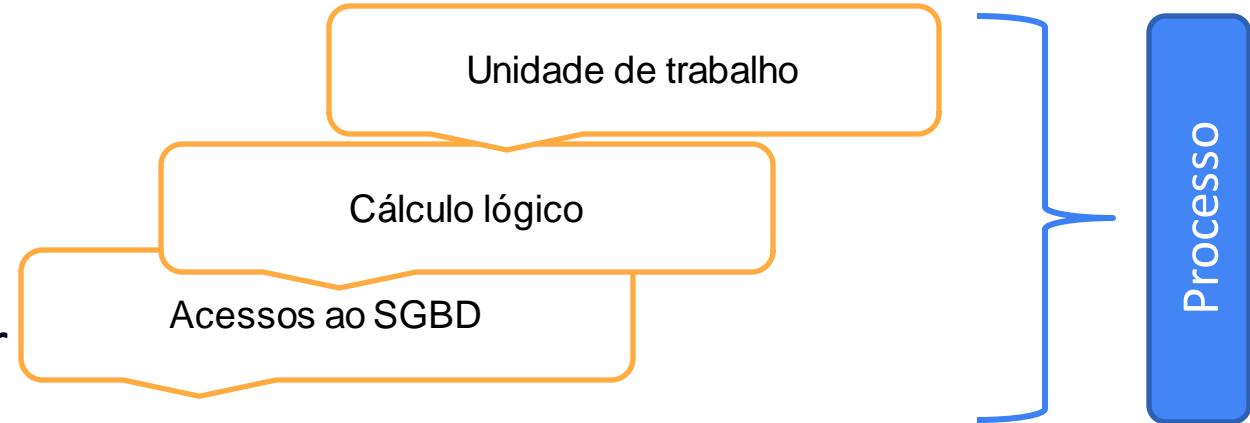
# OLTP

- App multiuser
- Gerenciador: transações concorrentes

Online Transaction Processing

# OLTP

- App multiuser
- Gerenciador: transações concorrentes



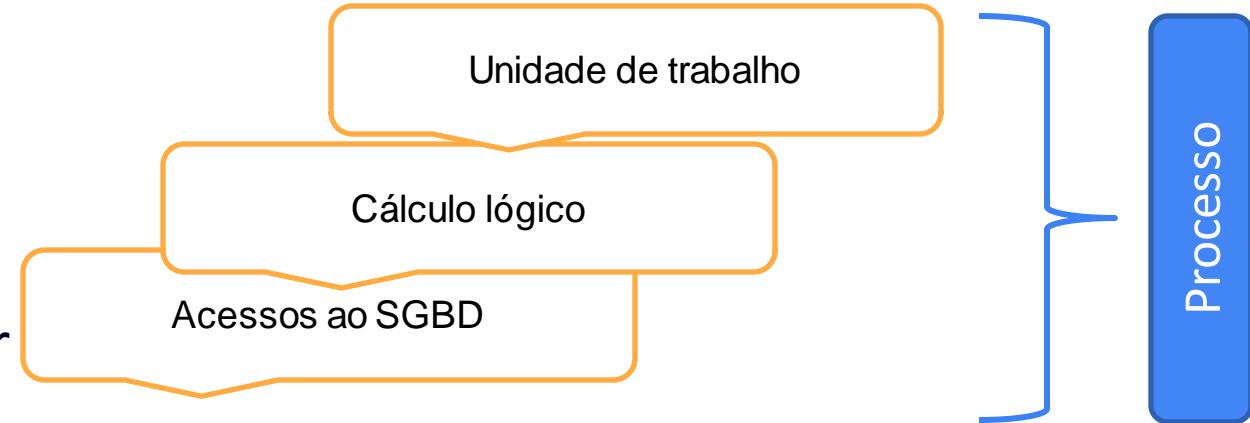
Execução sem interferência

Isolamento

Online Transaction Processing

# OLTP

- App multiuser
- Gerenciador: transações concorrentes



Execução sem interferência

Atomicidade

**8 ou 80!**

Online Transaction Processing

# OLTP



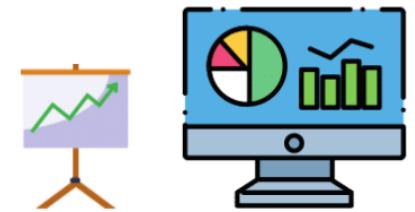
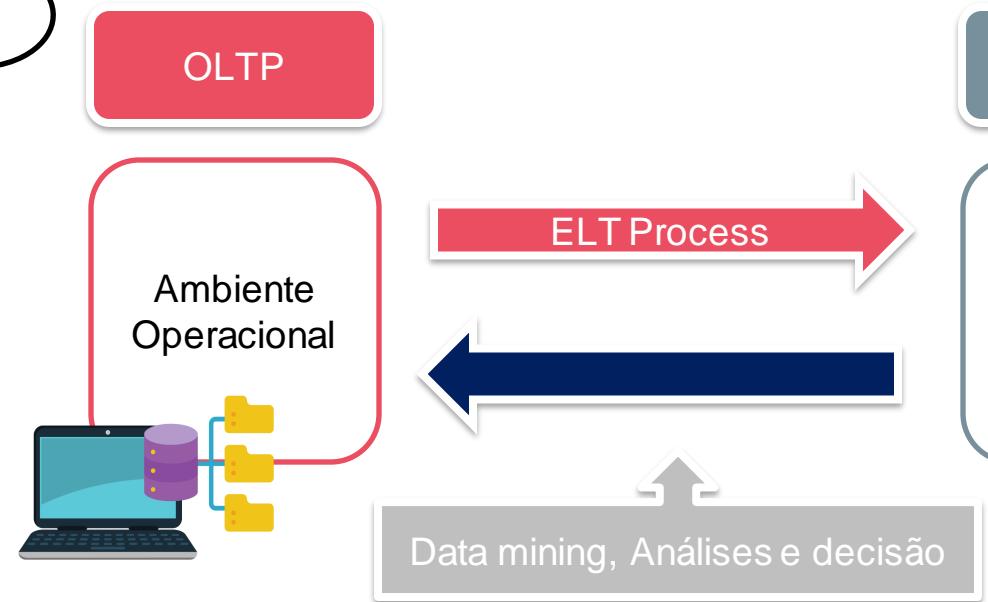
Operacional

Processamento de dados

Processamento de dados

Transaction-driven

# OLTP

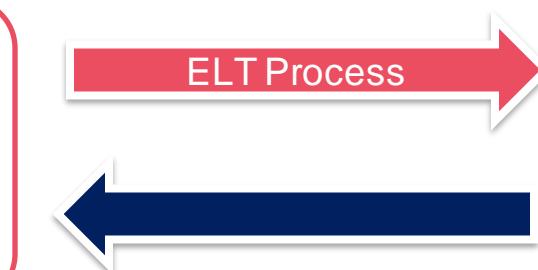


Data mining, Análises e decisão

# OLTP



ELT Process



Data mining, Análises e decisão

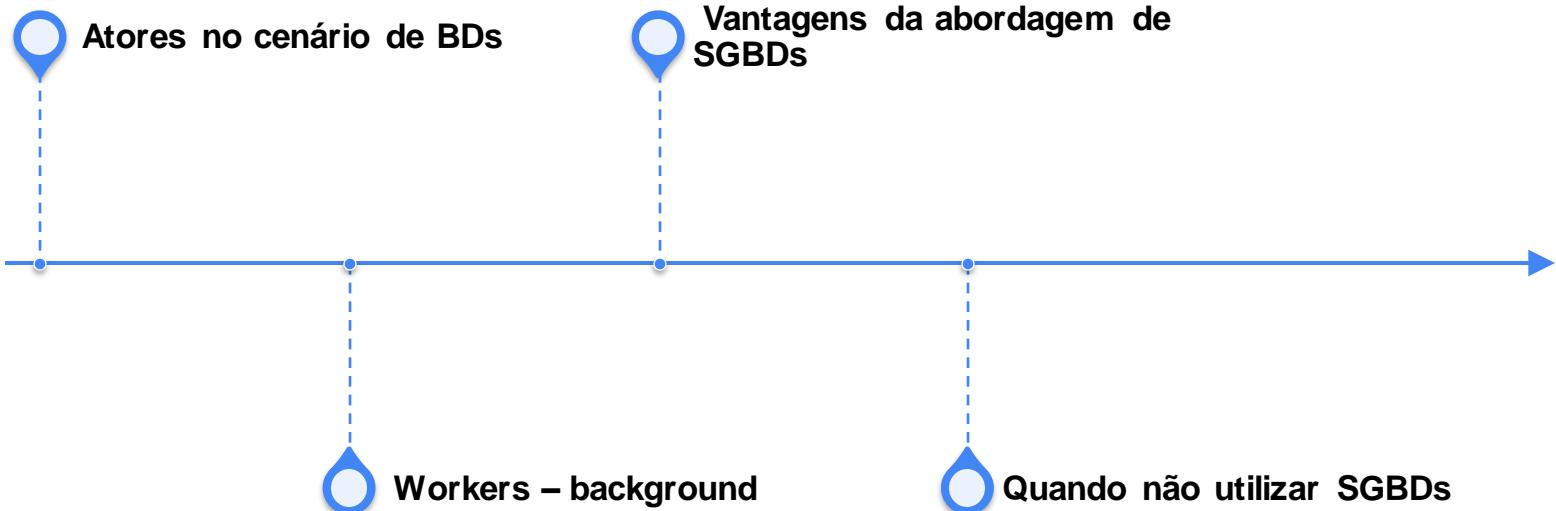


## Etapa 6

# Explorando abordagem de SGBDs – Atores, Workers nos bastidores, Vantagens e Quando não utilizar?

// Introdução à Banco de dados

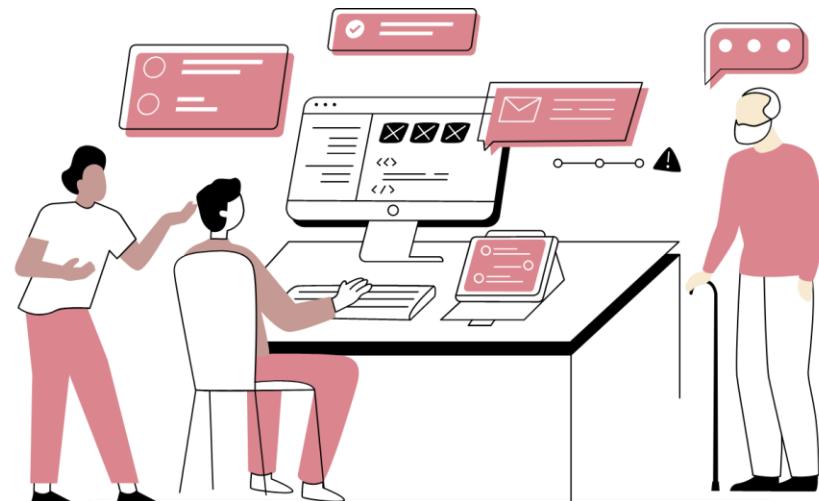
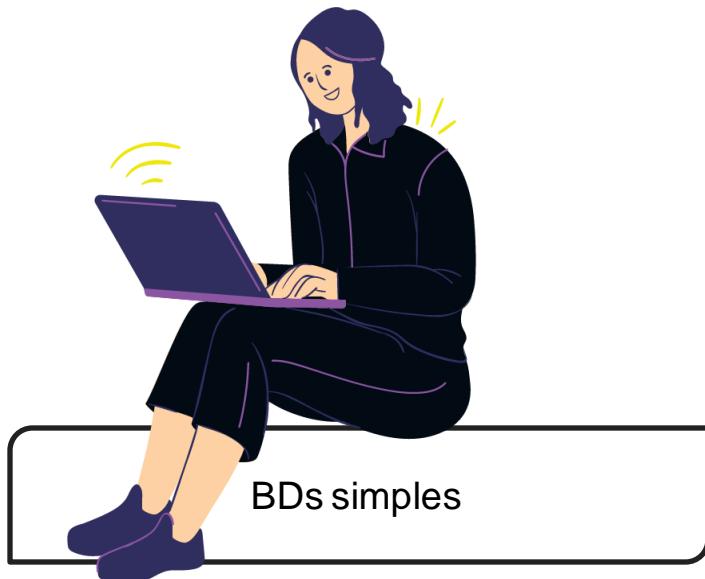
# Conversa



# Quais são os atores em Banco de Dados?

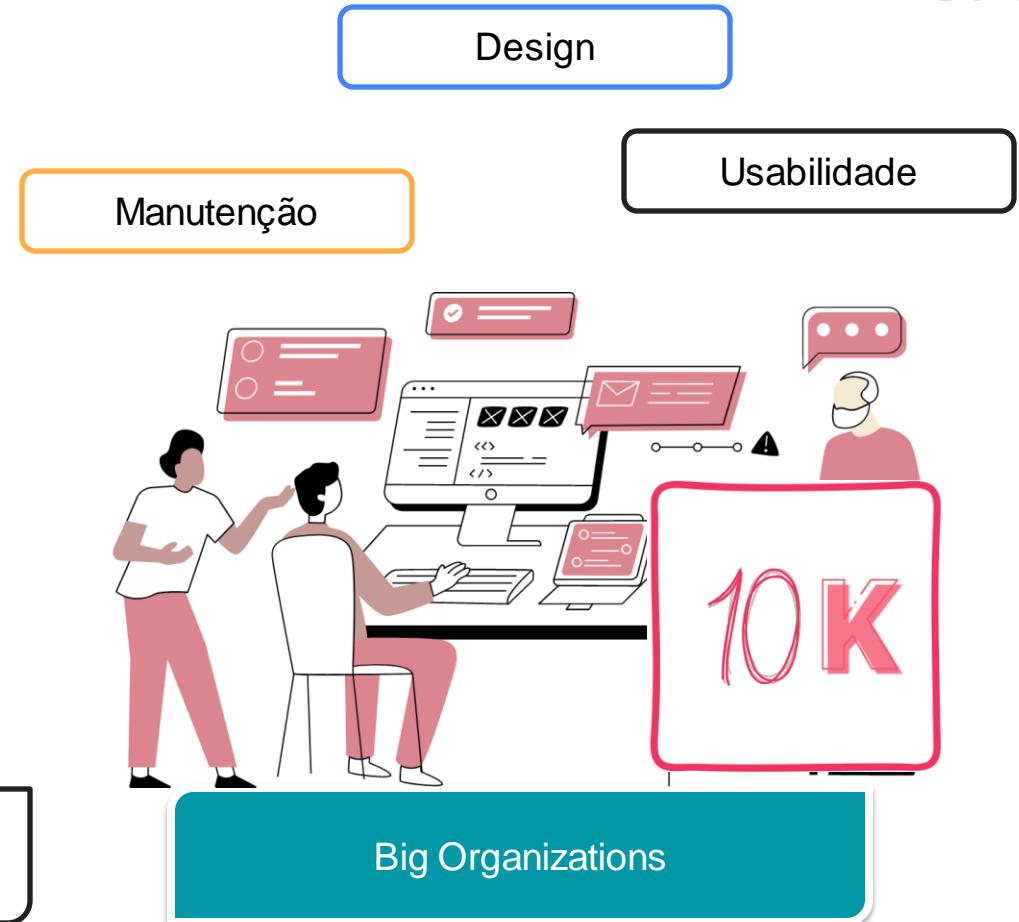
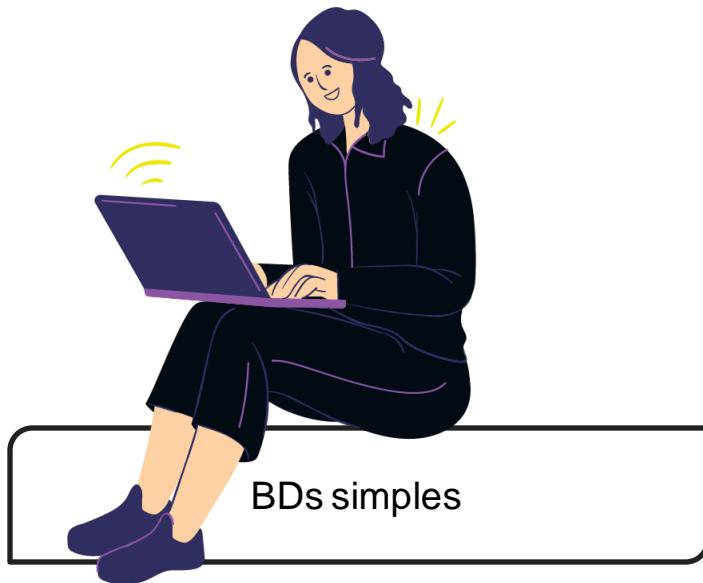


# Atores



Big Organizations

# Atores



# Atores



Administrador

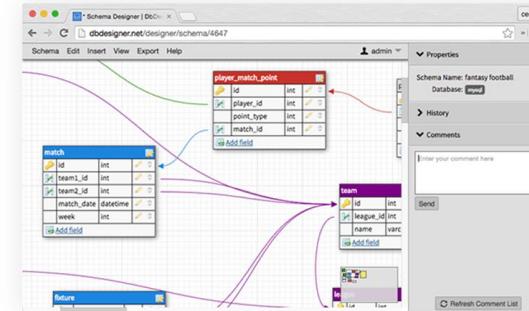
Designers

- Dia-a-dia
- Diretamente ligados ao contexto

Usuários finais



# Atores - Designer

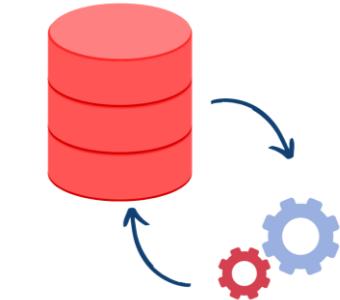


- Identificar dados e requisitos
- Representação e Estrutura
- Fase preliminar

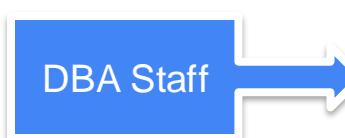
Modelagem



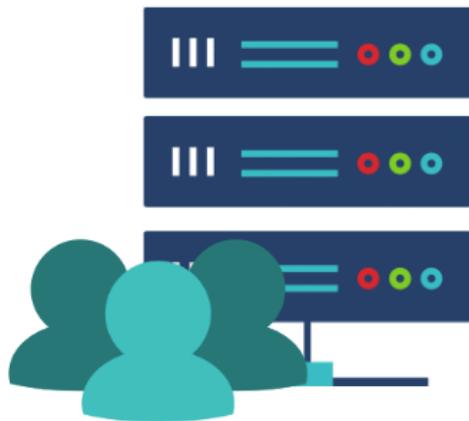
# Atores - Administrador



- Gerencia Recursos
- Orquestração
- Autorização de acesso



# Atores - Usuários Finais



- Acesso -> Querying
- Categorizados



Propósito do SGBD

# Atores - Usuários Finais

- Casuais
- Ingênuos
- Sofisticados
- Standalone

Acessos ocasionais

Diferentes informações

Uso de APIs



Propósito do SGBD

# Atores - Usuários Finais

- Casuais
- **Ingênuos**
- Sofisticados
- Standalone

Considerável porção

Canned Transactions

Erro: raro



Propósito do SGBD

# Atores - Usuários Finais

- Casuais
- **Ingênuos**
- Sofisticados
- Standalone



Propósito do SGBD

# Atores - Usuários Finais

- Casuais
- Ingênuos
- **Sofisticados**
- Standalone

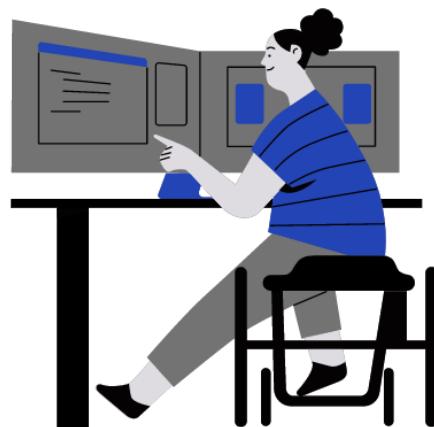


Propósito do SGBD

# Atores - Usuários Finais

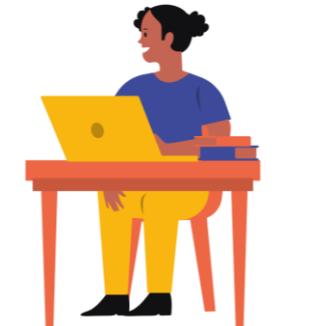
- Casuais
- Ingênuos
- Sofisticados
- **Standalone**

BD pessoal



Propósito do SGBD

# Atores - Usuários Finais

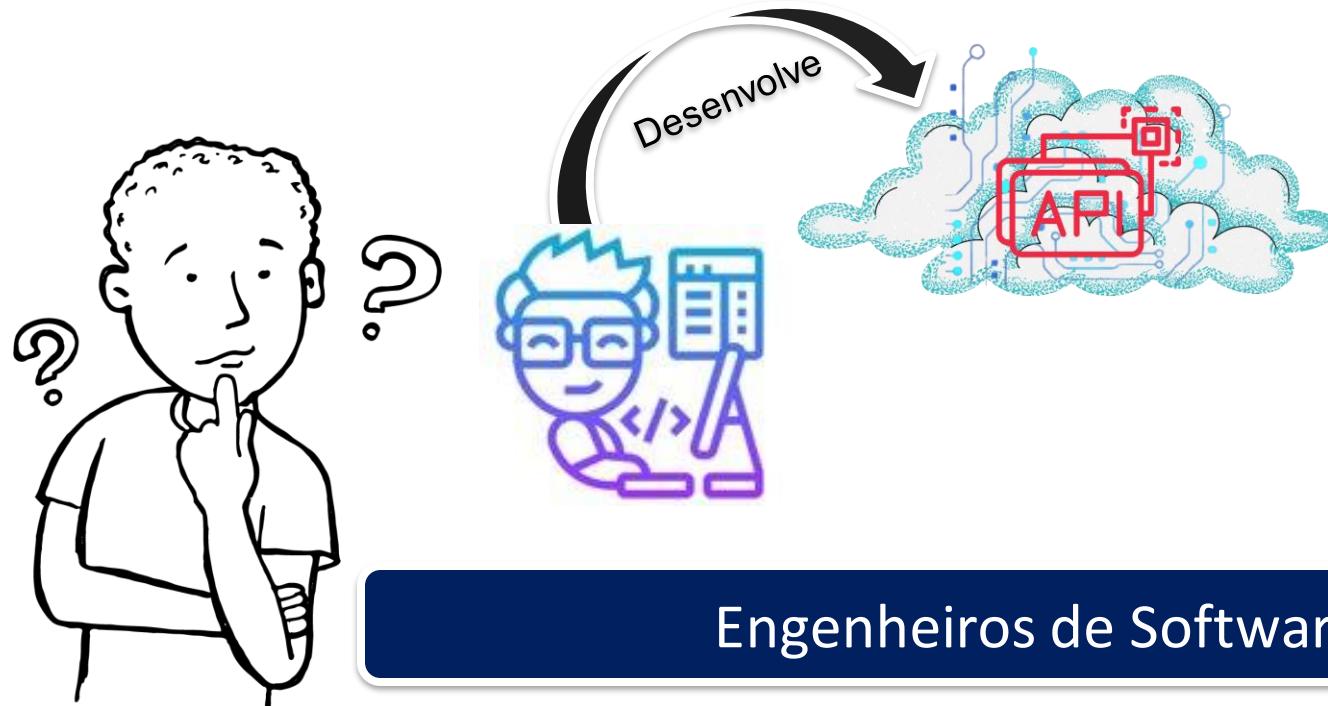


Diversas facilidades são implementadas para os users do SGBD

# Atores

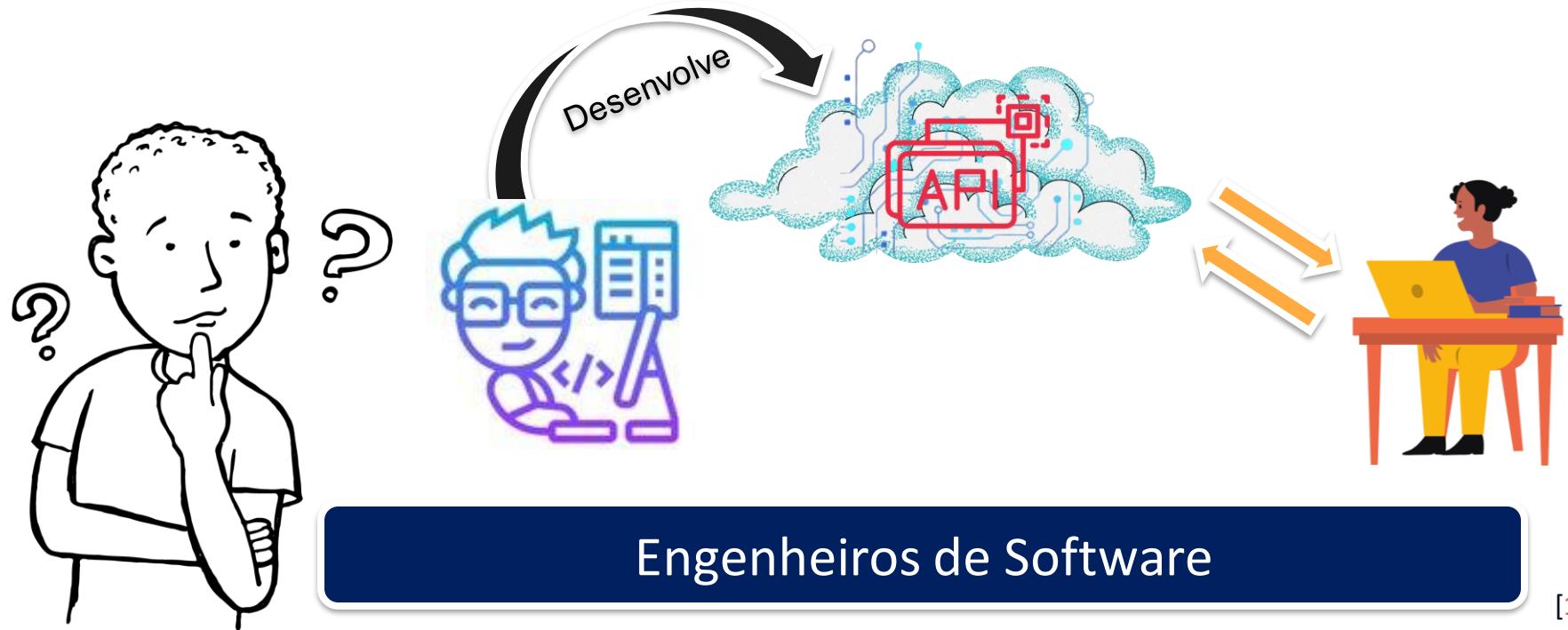


# Atores

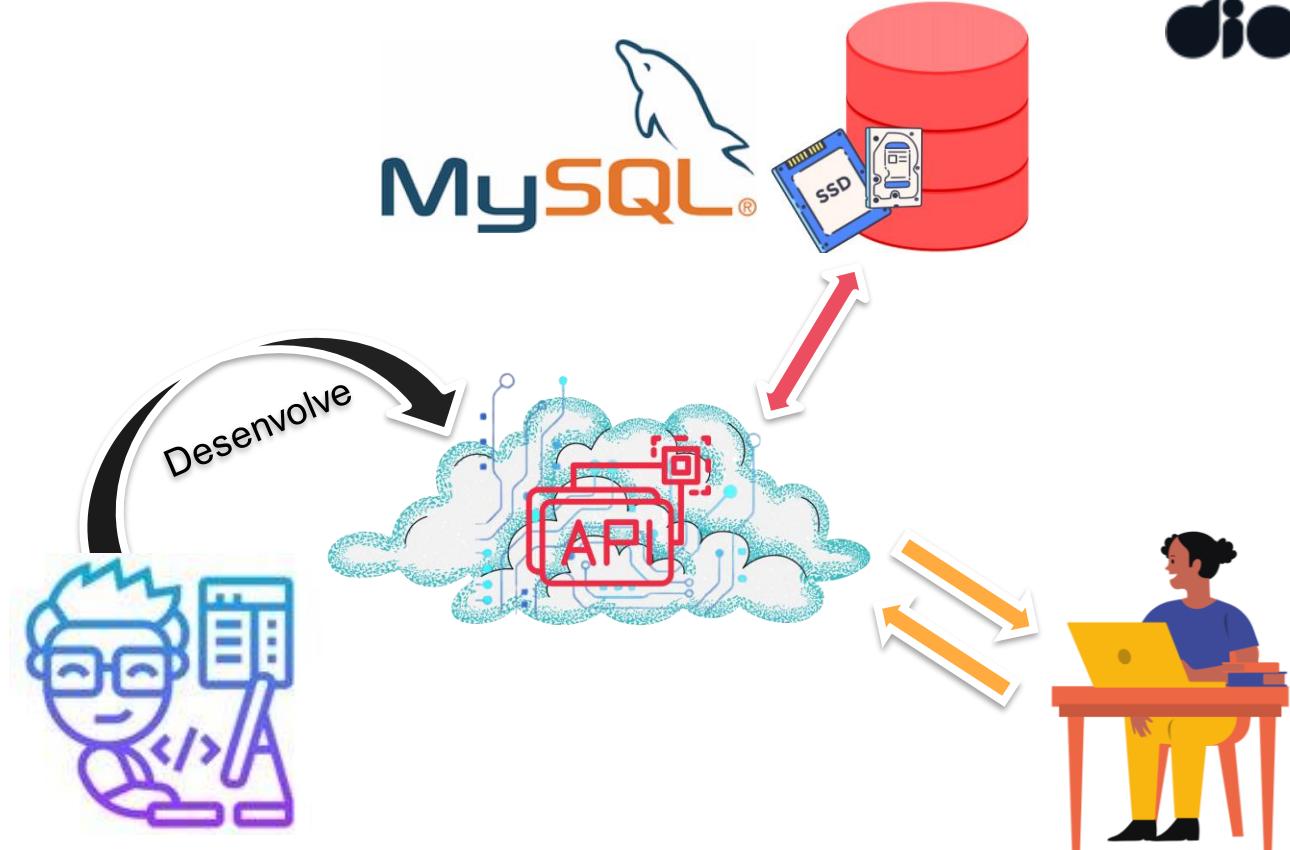


Engenheiros de Software

# Atores



# Atores



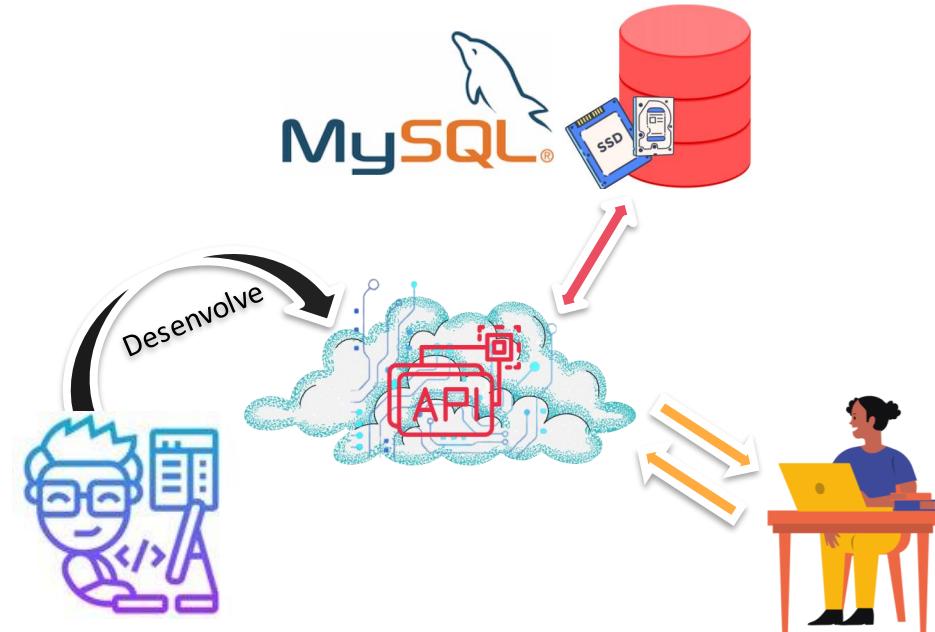
Engenheiros de Software

# Atores

Análise de Sistema

Desenvolvimento da  
aplicação

Teste e documentação da  
aplicação



Engenheiros de Software

# Workers em background – Banco de dados



# Background

Fora do contexto de BD

Designer do sistema de SGBD

Pessoal de operação e manutenção

Implementação do sistema de SGBD

Desenvolvedores de ferramentas

# Background

Mantém o SGBD disponível para users

Designer do sistema de SGBD

Pessoal de operação e manutenção

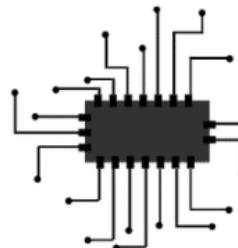
Implementação do sistema de SGBD

Desenvolvedores de ferramentas

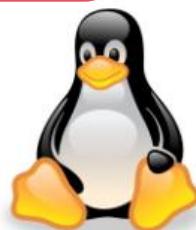
# Background



# Background



Responsável pelo ambiente de hardware e software para SGBD



Designer do sistema de SGBD

Pessoal de operação e manutenção

Implementação do sistema de SGBD

Desenvolvedores de ferramentas

# Background



Ferramentas opcionais para diversos fins, como:  
performance, modelagem, análise



Designer do sistema de SGBD

Pessoal de operação e manutenção

Implementação do sistema de SGBD

Desenvolvedores de ferramentas

# Vantagens de utilizar a abordagem com SGBD



# Vantagens do SGBD

Abstração

Auto-descrição

Isolamento

Compartilhamento

Múltiplas visões

Transação  
multiuser

Além das 4 características...

# Vantagens do SGBD



Controle de Redundância

Restrição de acesso

Storage – prove persistência

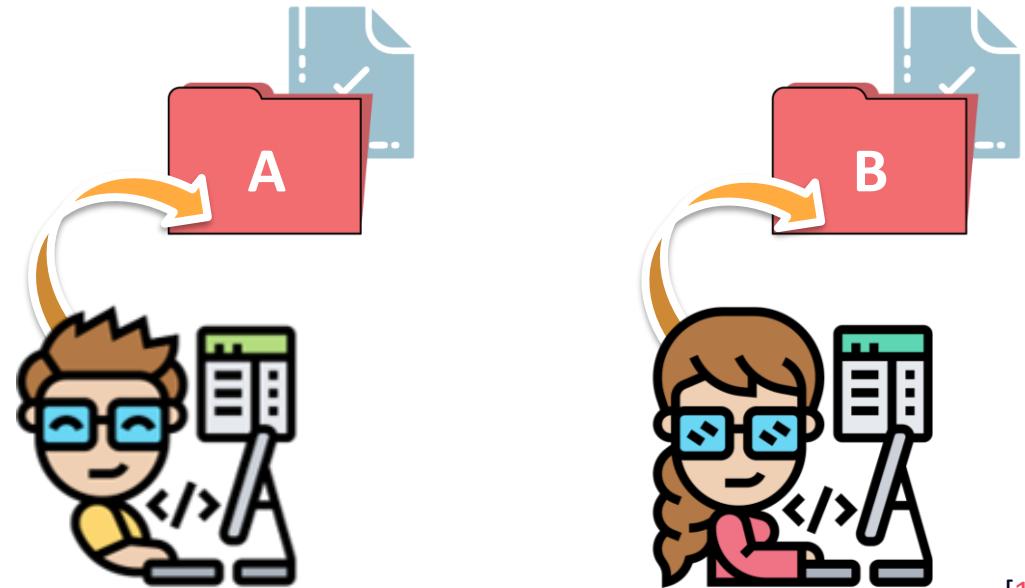
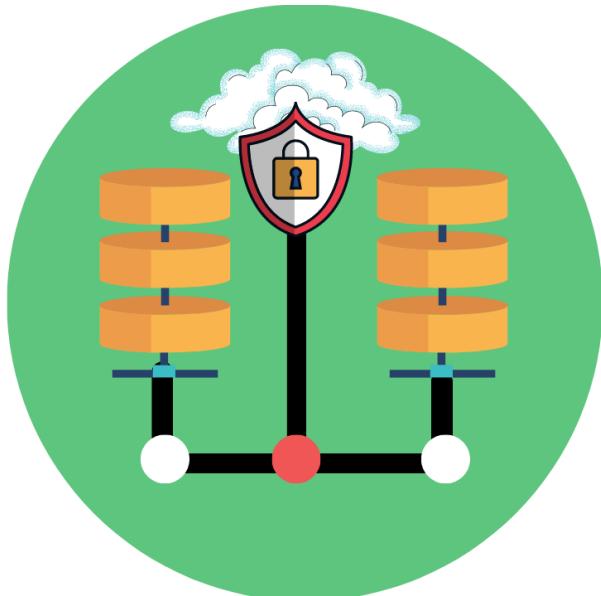
Storage – prove estrutura

Backup e Recovery

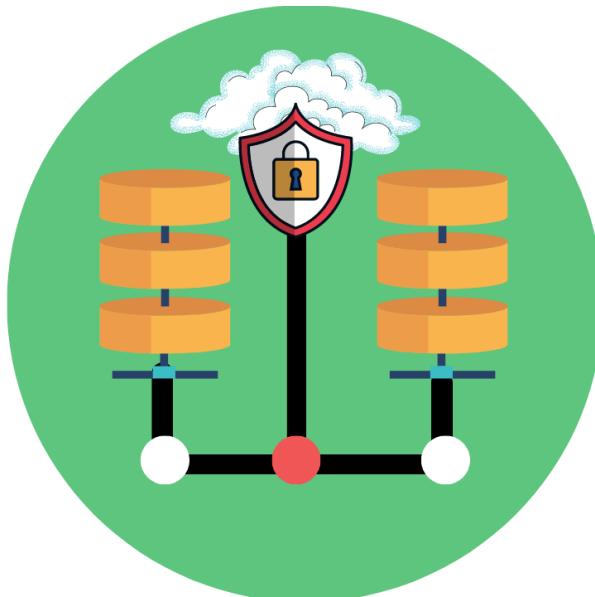


# Vantagens do SGBD

Controle de Redundância



# Vantagens do SGBD



## Controle de Redundância

C: (storage)  
Estudantes  
Cursos  
Relação alunoxcurso  
...



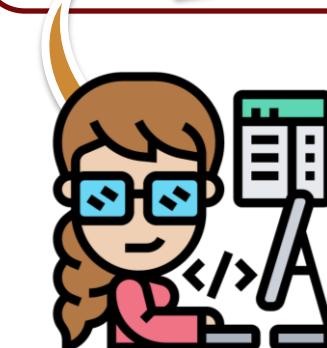
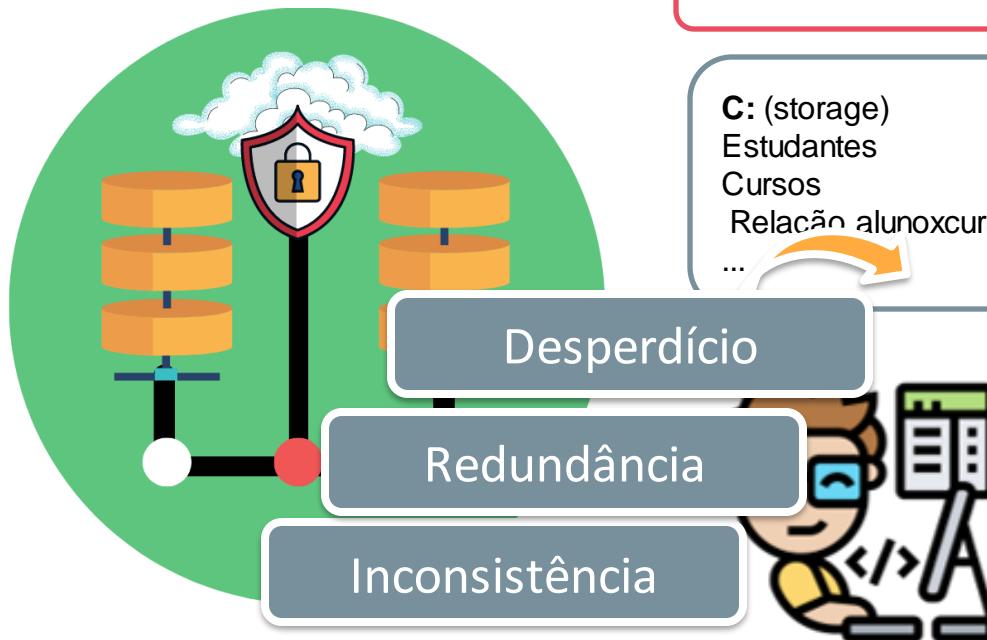
D: (storage)  
Estudantes  
Cursos  
Relação alunoxcurso  
...



# Vantagens do SGBD

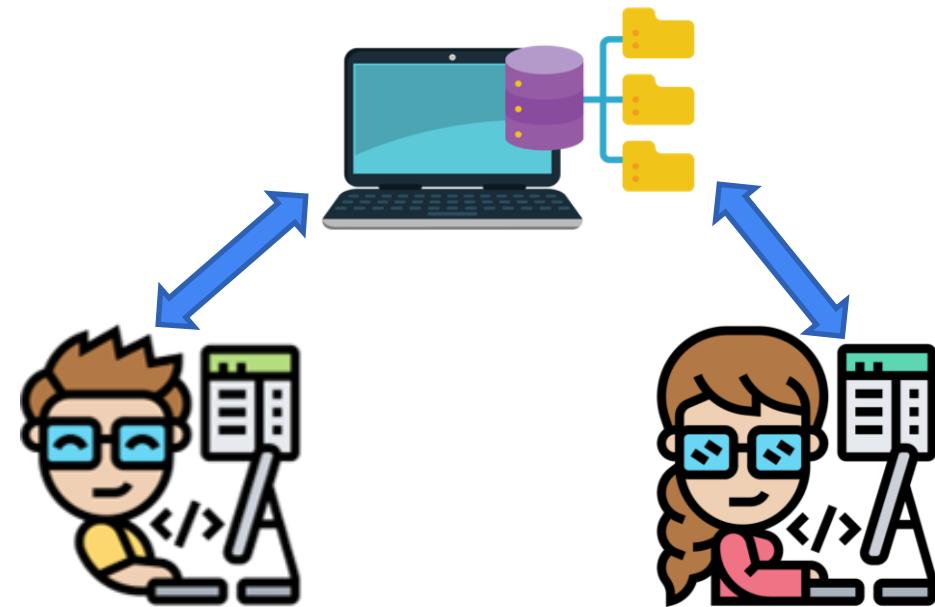
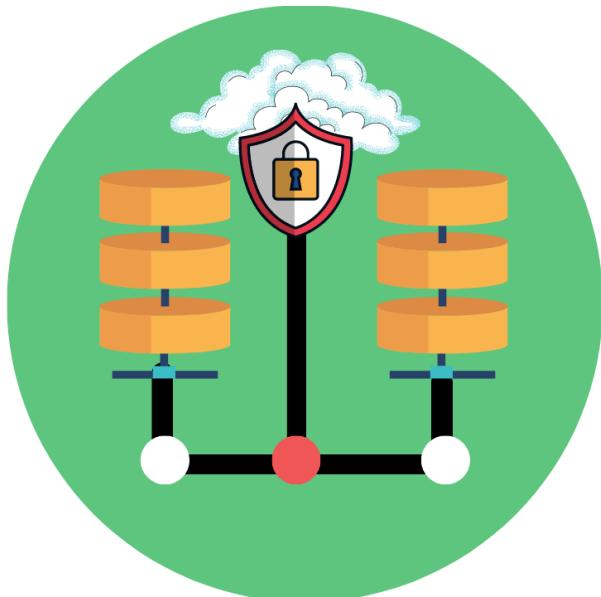
Updates desnecessários

Controle de Redundância

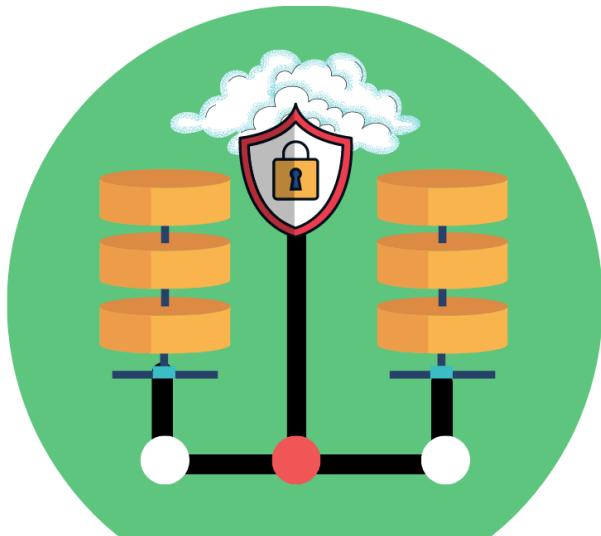


# Vantagens do SGBD

Controle de Redundância



# Vantagens do SGBD

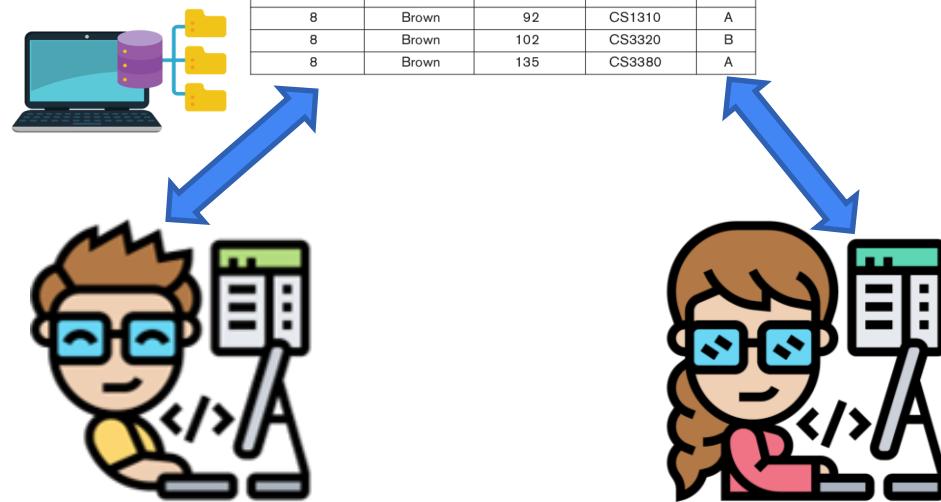


Desnormalização

## Controle de Redundância

GRADE\_REPORT

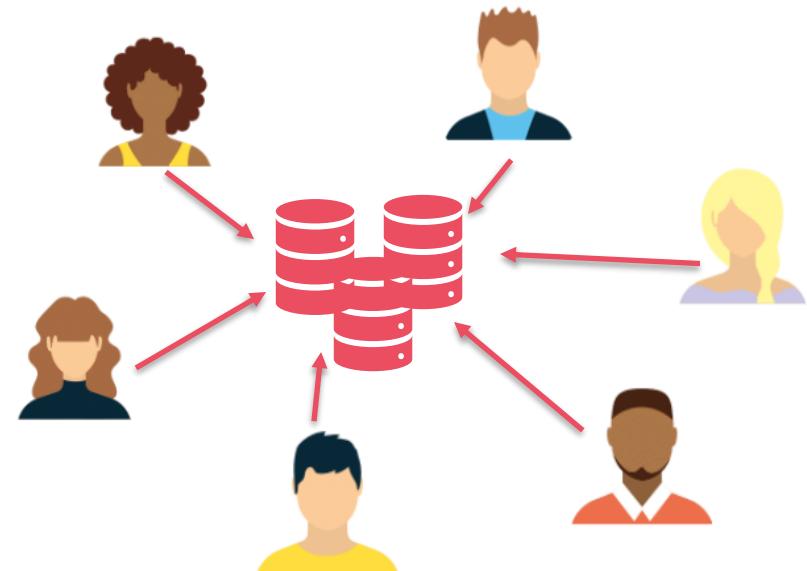
| Student_number | Student_name | Section_identifier | Course_number | Grade |
|----------------|--------------|--------------------|---------------|-------|
| 17             | Smith        | 112                | MATH2410      | B     |
| 17             | Smith        | 119                | CS1310        | C     |
| 8              | Brown        | 85                 | MATH2410      | A     |
| 8              | Brown        | 92                 | CS1310        | A     |
| 8              | Brown        | 102                | CS3320        | B     |
| 8              | Brown        | 135                | CS3380        | A     |



# Vantagens do SGBD



Restrição de acesso



# Vantagens do SGBD

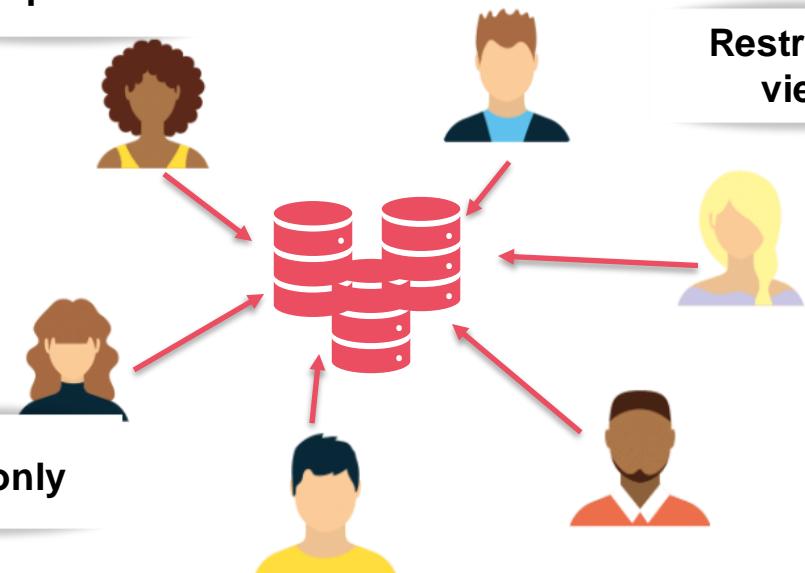


Restrição de acesso

Update

Restricted view

Read-only



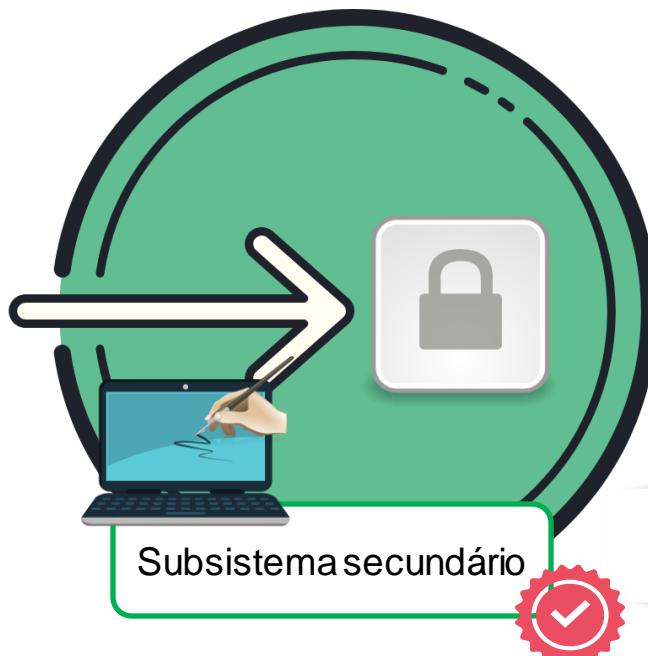
# Vantagens do SGBD

DBA

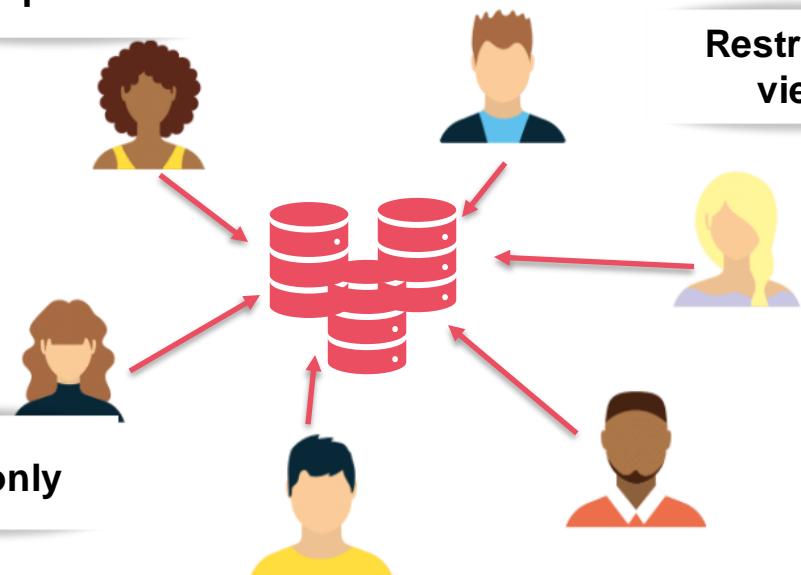
Restrição de acesso

Update

Restricted view

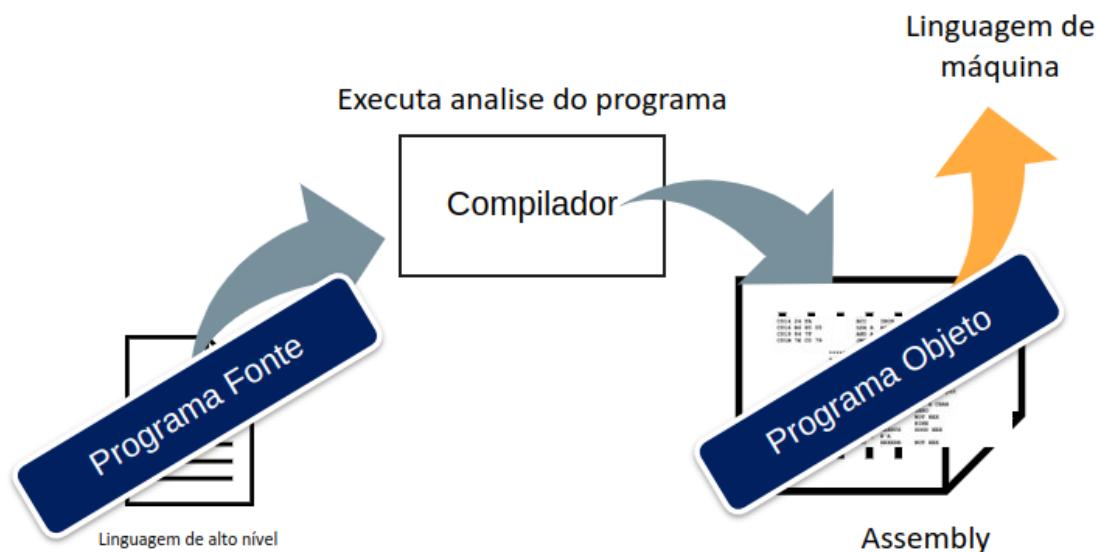


Read-only



# Vantagens do SGBD

Provendo Persistência

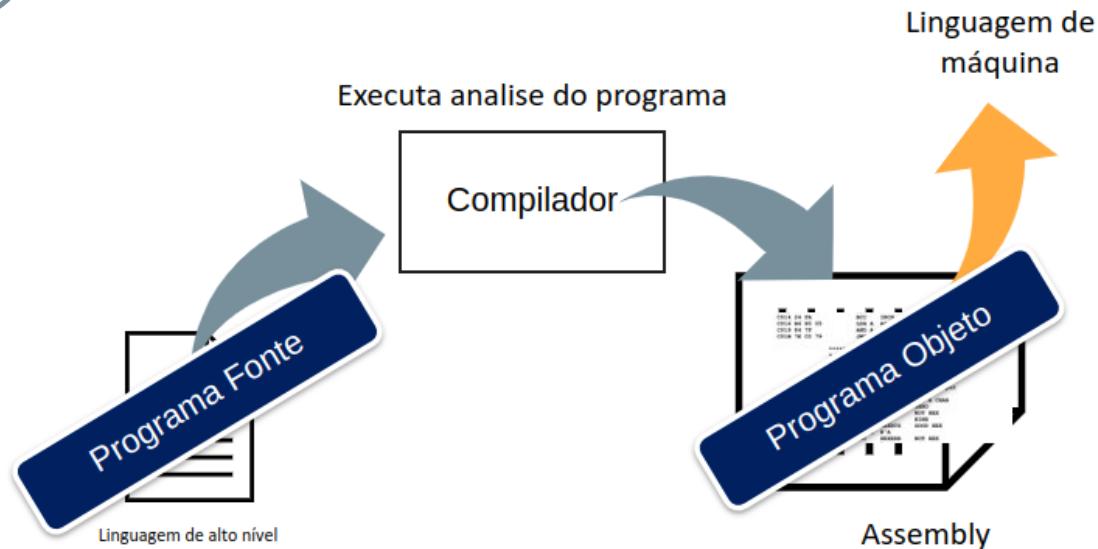


# Vantagens do SGBD

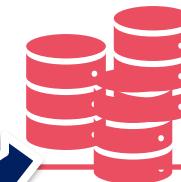
O que acontece com  
os dados de um  
programa objeto?



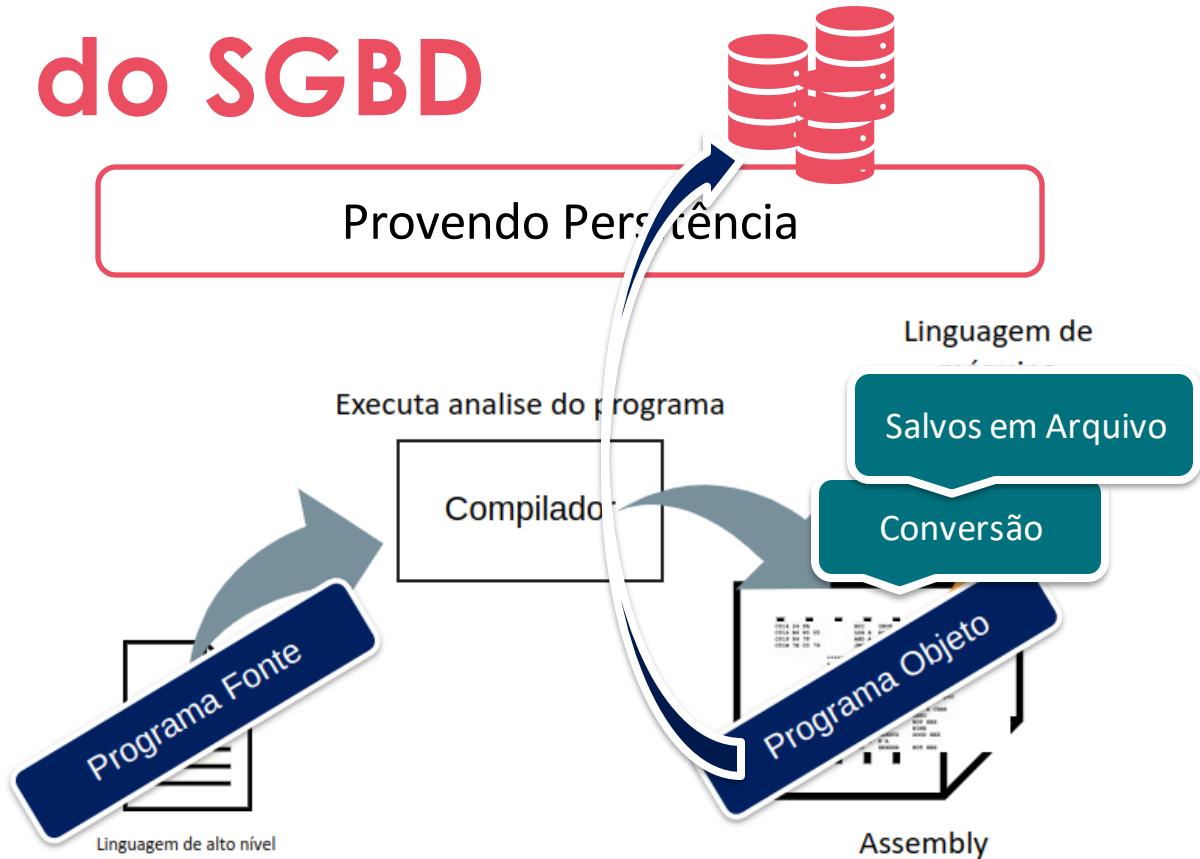
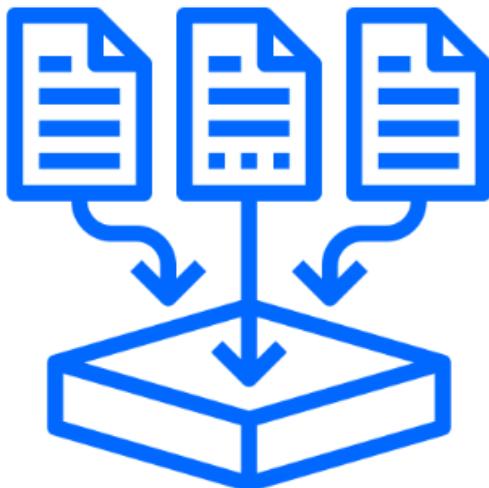
## Provendo Persistência



# Vantagens do SGBD

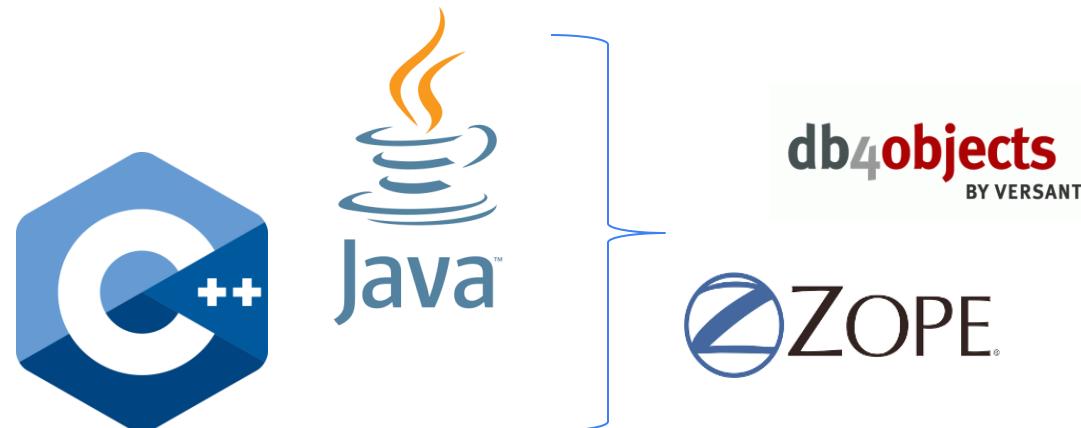
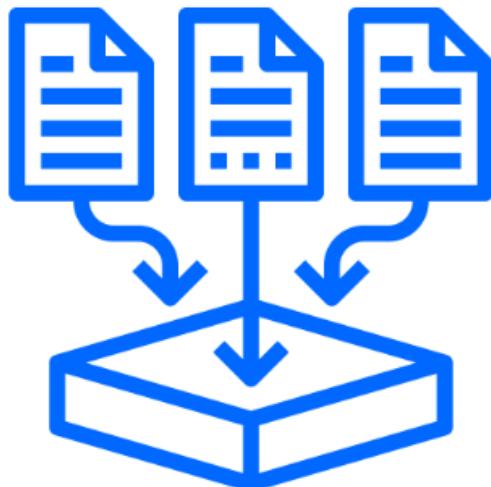


Provendo Persistência



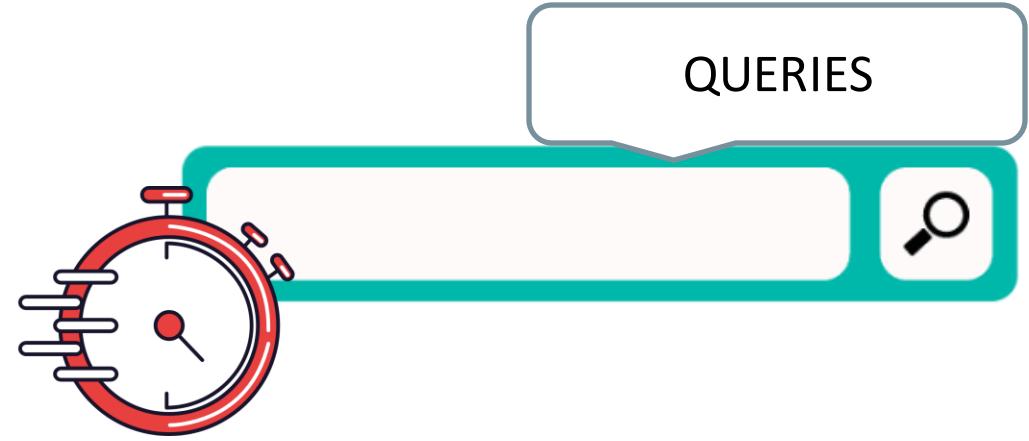
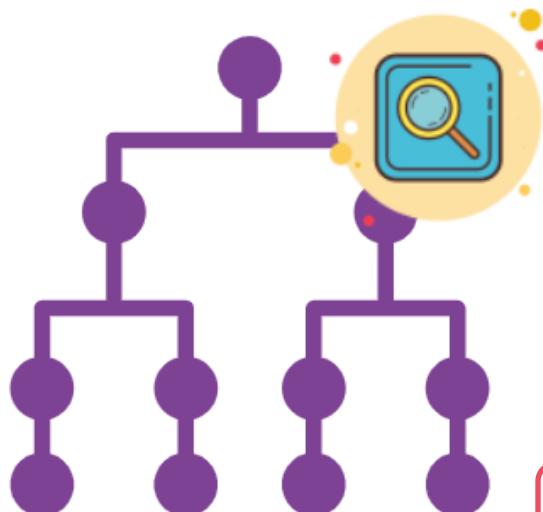
# Vantagens do SGBD

Provendo Persistência



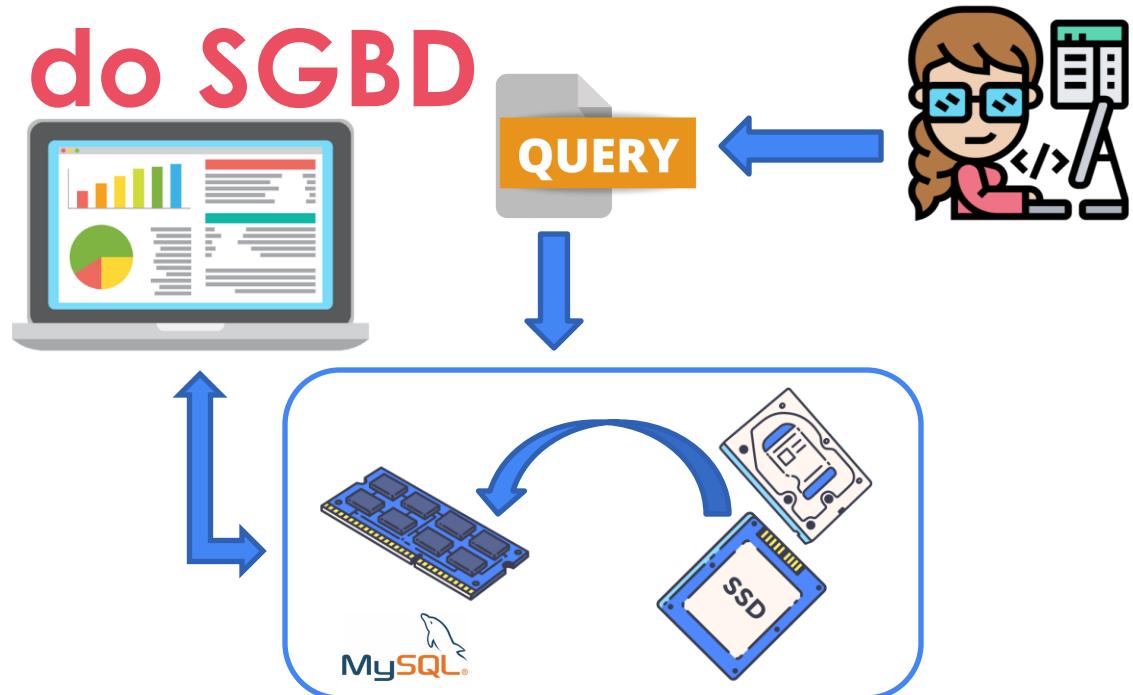
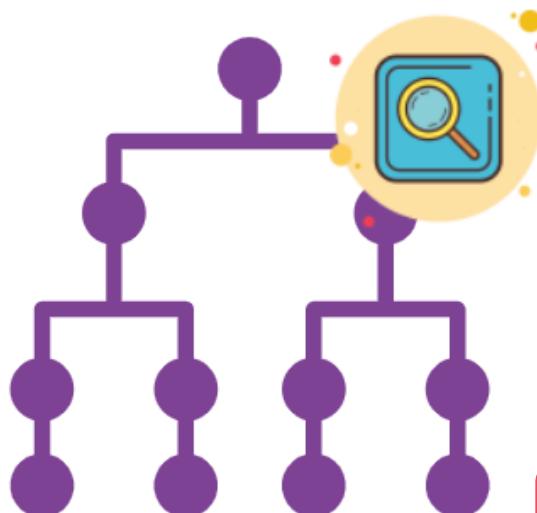
Impedance Mismatch Problem

# Vantagens do SGBD



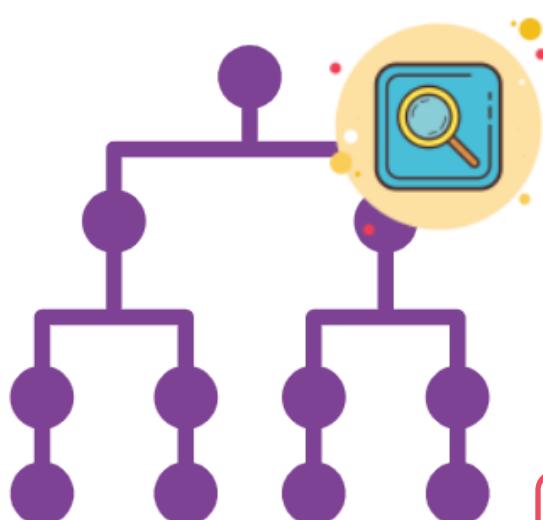
Estrutura de armazenamento e Técnicas de busca

# Vantagens do SGBD



Estrutura de armazenamento e Técnicas de busca

# Vantagens do SGBD



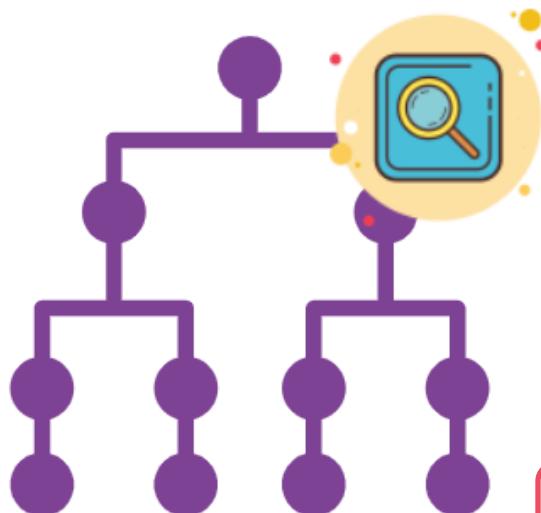
```
SELECT course_nome FROM COURSES WHERE  
Credit_hours = MAX(Credit_hours)
```

COURSE

| Course_name               | Course_number | Credit_hours | Department |
|---------------------------|---------------|--------------|------------|
| Intro to Computer Science | CS1310        | 4            | CS         |
| Data Structures           | CS3320        | 4            | CS         |
| Discrete Mathematics      | MATH2410      | 3            | MATH       |
| Database                  | CS3380        | 3            | CS         |

Estrutura de armazenamento e Técnicas de busca

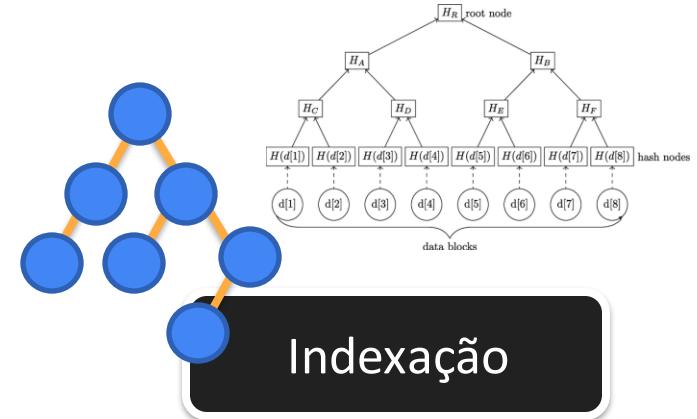
# Vantagens do SGBD



Caching

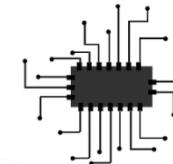
Buffering

Estrutura de armazenamento e Técnicas de busca

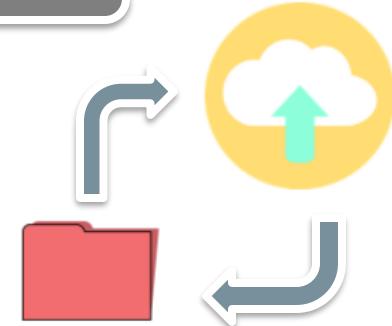


# Vantagens do SGBD

Backup e Recovery

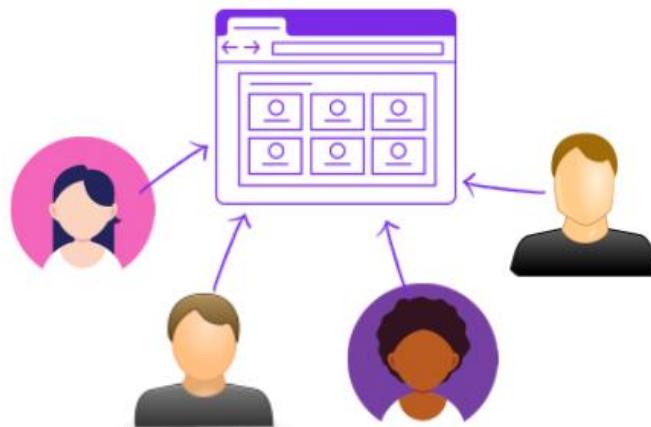


Recursos de Recovery



# Vantagens do SGBD

Provendo interface Multi-user



Perfis de usuário

Interfaces

# Vantagens do SGBD

Mobile apps

Provendo interface Multi-user

Natural Language Interface

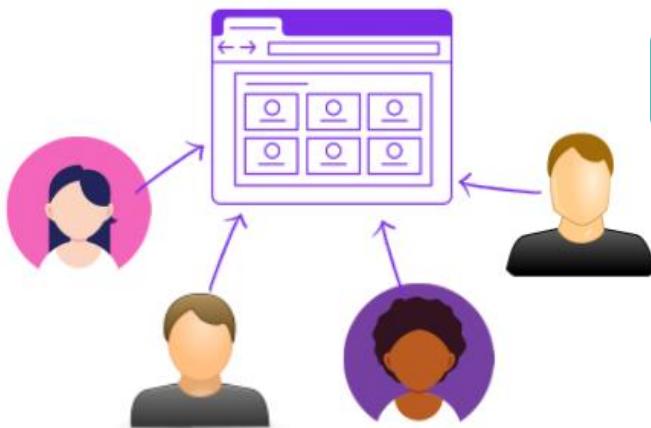
Query language

Forms & command codes



Menu-driven

Programming lang. interface



# Vantagens do SGBD



Repres. Relações complexas

- Variedade de dados inter-relacionados

STUDENT

| Name  | Student_number | Class | Major |
|-------|----------------|-------|-------|
| Smith | 17             | 1     | CS    |
| Brown | 8              | 2     | CS    |

GRADE\_REPORT

| Student_number | Section_identifier | Grade |
|----------------|--------------------|-------|
| 17             | 112                | B     |
| 17             | 119                | C     |
| 8              | 85                 | A     |
| 8              | 92                 | A     |
| 8              | 102                | B     |
| 8              | 135                | A     |

# Vantagens do SGBD

Integridade de dados



Data type



Definição e Imposição



# Vantagens do SGBD

## Integridade de dados

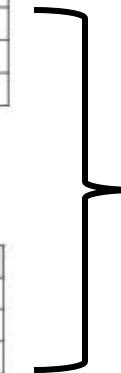


COURSE

| Course_name                      | Course_number | Credit_hours | Department |
|----------------------------------|---------------|--------------|------------|
| Introduction to Computer Science | CS1310        | 4            | CS         |
| Data Structures                  | CS3320        | 4            | CS         |
| Discrete Mathematics             | MATH2410      | 3            | MATH       |
| Database                         | CS3380        | 3            | CS         |

SECTION

| Section_identifier | Course_number | Semester | Year | Instructor |
|--------------------|---------------|----------|------|------------|
| 85                 | MATH2410      | Fall     | 07   | King       |
| 92                 | CS1310        | Fall     | 07   | Anderson   |
| 102                | CS3320        | Spring   | 08   | Knuth      |
| 112                | MATH2410      | Fall     | 08   | Chang      |
| 119                | CS1310        | Fall     | 08   | Anderson   |
| 135                | CS3380        | Fall     | 08   | Stone      |



Integridade  
de  
Referência

# Vantagens do SGBD

Integridade de dados



Regras de Domínio

Asserções

Integridade Referencial

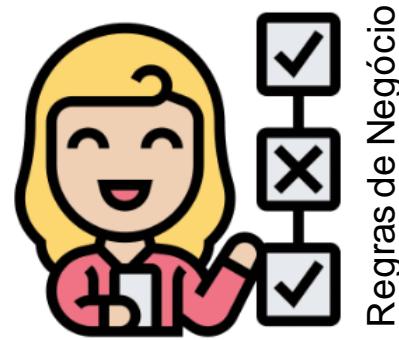
Gatilhos

Dependências Funcionais

Constrains and Triggers

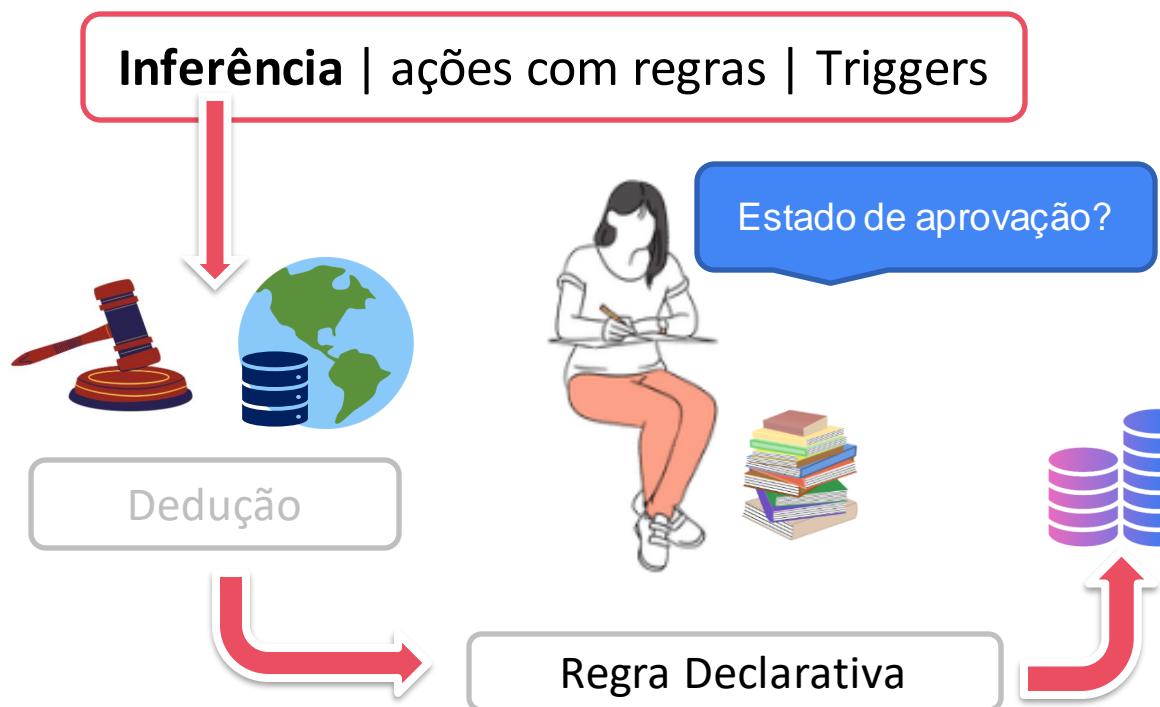
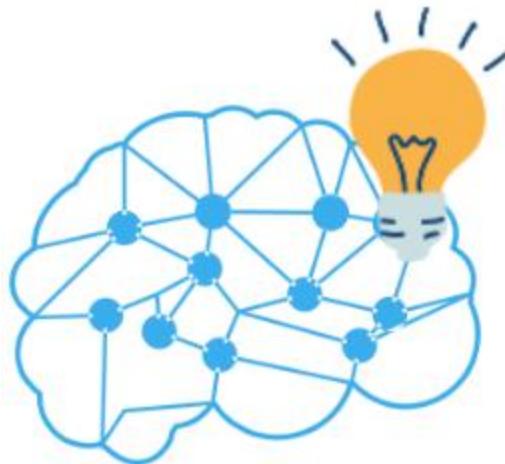
# Vantagens do SGBD

Integridade de dados

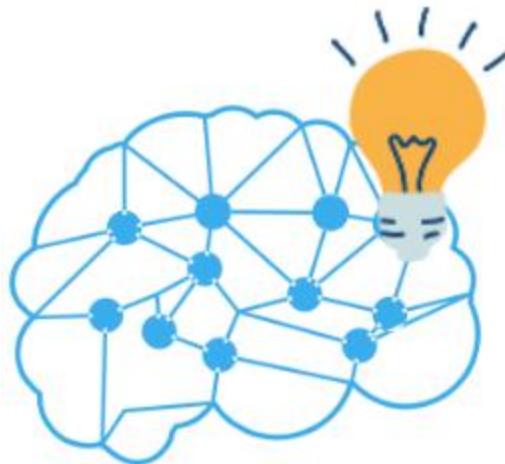


Semântica

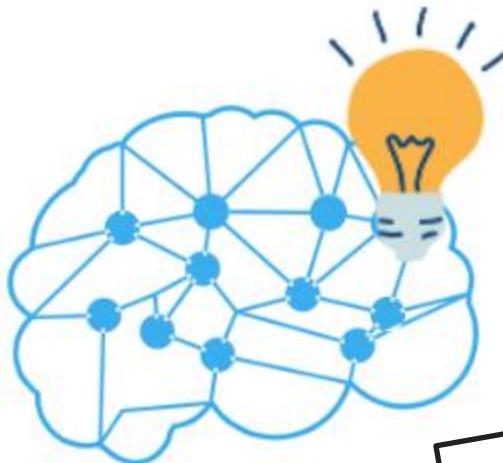
# Vantagens do SGBD



# Vantagens do SGBD



# Vantagens do SGBD



Inferência | ações com regras | Triggers

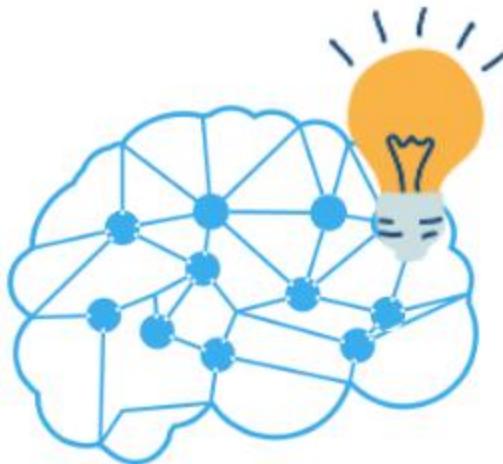
Regras e dedução

Prog. Procedural

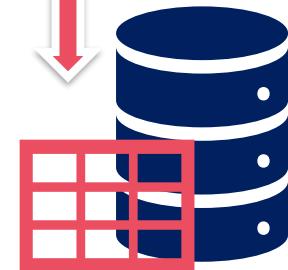
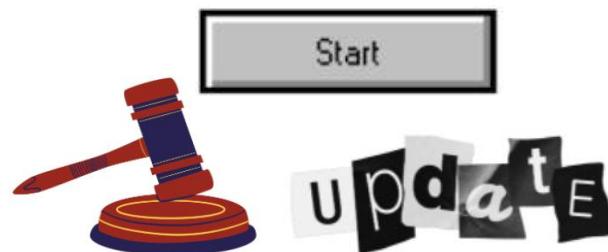
Regra Declarativa



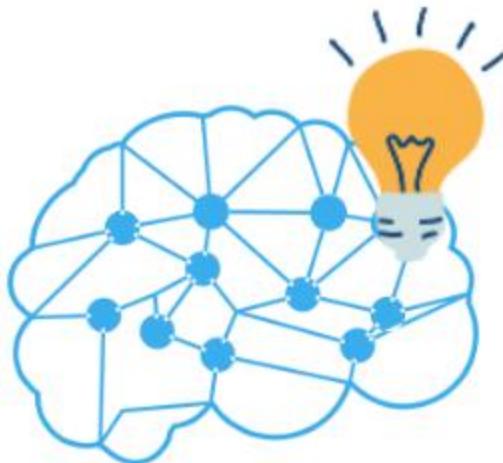
# Vantagens do SGBD



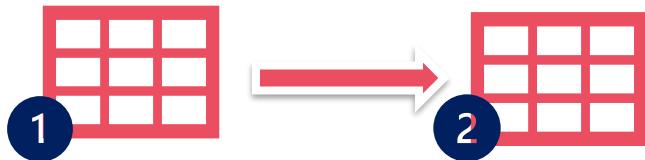
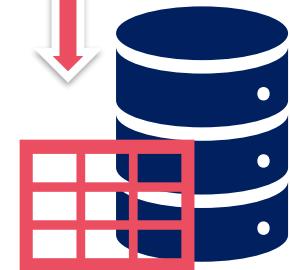
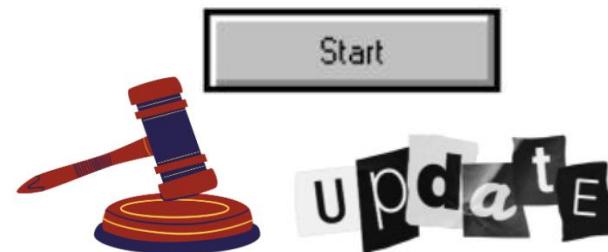
Inferência | ações com regras | Triggers



# Vantagens do SGBD



Inferência | ações com regras | Triggers



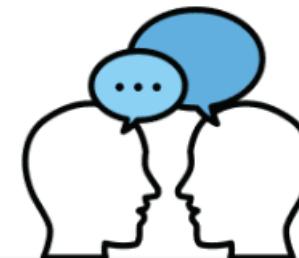
# Ganhos em utilizar Sistemas de Gerenciamento de Banco de Dados



# Ganhos com SGBD



- Padronização
- Redução de tempo no desenvolvimento da aplicação
- Flexibilidade
- Disponibilidade de info atualizadas
- Economia com escalabilidade



# Ganhos com SGBD

Entre databases dentro da organização.



- Padronização

• Redução de tempo no desenvolvimento da

Tipos de dados

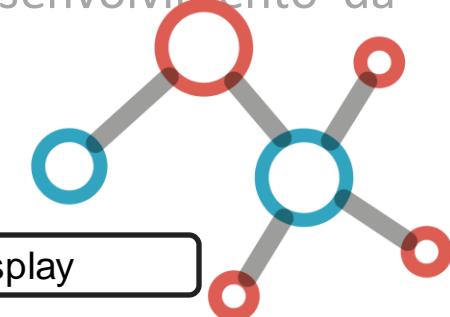
• Flexibilidade

• Disponibilidade de

Display

• Economia com escalabilidade

Relatórios



# Padronização

## PREREQUISITE

| Course_number | Prerequisite_number |
|---------------|---------------------|
| CS3380        | CS3320              |
| CS3380        | MATH2410            |
| CS3320        | CS1310              |

## STUDENT

| Name  | Student_number | Class | Major |
|-------|----------------|-------|-------|
| Smith | 17             | 1     | CS    |
| Brown | 8              | 2     | CS    |

## COURSE

Tipo de dados

| Course_name               | Course_number | Credit_hours | Department |
|---------------------------|---------------|--------------|------------|
| Intro to Computer Science | CS1310        | 4            | CS         |
| Data Structures           | CS3320        | 4            | CS         |
| Discrete Mathematics      | MATH2410      | 3            | MATH       |
| Database                  | CS3380        | 3            | CS         |

## SECTION

Estrutura definida

| Section_identifier | Course_number | Semester | Year | Instructor |
|--------------------|---------------|----------|------|------------|
| 85                 | MATH2410      | Fall     | 07   | King       |
| 92                 | CS1310        | Fall     | 07   | Anderson   |
| 102                | CS3320        | Spring   | 08   | Knuth      |
| 112                | MATH2410      | Fall     | 08   | Chang      |
| 119                | CS1310        | Fall     | 08   | Anderson   |
| 135                | CS3380        | Fall     | 08   | Stone      |

Base dos relatórios

## GRADE REPORT

| Student_number | Section_identifier | Grade |
|----------------|--------------------|-------|
| 17             | 112                | B     |
| 17             | 119                | C     |
| 8              | 85                 | A     |
| 8              | 92                 | A     |
| 8              | 102                | B     |
| 8              | 135                | A     |

# Ganhos com SGBD



- P Features do app descontinuadas: **retrieval**
- Redução de tempo no desenvolvimento da aplicação
- Flexibilidade
- Disponibilidade de info atualizadas
- Economia com escalabilidade



# Ganhos com SGBD



- Padronização
- Redução de tempo no desenvolvimento da aplicação
- Flexibilidade
- Disponibilidade de info atualizadas
- Economia com escalabilidade



# Ganhos com SGBD



- Padronização
- Redução de custos no desenvolvimento da aplicação
- Flexibilidade
- Disponibilidade de info atualizadas
- Economia com escalabilidade



Novo requisito



# Time

## PREREQUISITE

| Course_number | Prerequisite_number |
|---------------|---------------------|
| CS3380        | CS3320              |
| CS3380        | M                   |
| CS3320        | C                   |

Adicionar ano que cursou matéria

## STUDENT

| Name  | Student_number | Class | Major |
|-------|----------------|-------|-------|
| Smith | 17             | 1     | CS    |
|       |                | 2     | CS    |

Adicionar coordenador

## COURSE

| Course_name               | Course_number | Credit_hours | Department |
|---------------------------|---------------|--------------|------------|
| Intro to Computer Science | CS1310        | 4            | CS         |
| Data Structures           | CS3320        | 4            | CS         |
| Discrete Mathematics      | MATH2410      | 3            | MATH       |
| Database                  | CS3380        | 3            | CS         |

## SECTION

| Section_identifier | Course_number | Semester | Year | Instructor |
|--------------------|---------------|----------|------|------------|
| 85                 | MATH2410      | Fall     | 07   | King       |
| 92                 | CS1310        | Fall     | 07   | Anderson   |
| 102                | CS3320        | Spring   | 08   | Knuth      |
| 112                | MATH2410      | Fall     | 08   | Chang      |
|                    | CS1310        | Fall     | 08   | Anderson   |
|                    | CS3380        | Fall     | 08   | Stone      |

## GRADE REPORT

| Student_number | Section_identifier | Grade |
|----------------|--------------------|-------|
| 17             | 112                | B     |
| 17             | 119                | C     |
| 8              | 85                 | A     |
| 8              | 92                 | A     |
| 8              | 102                | B     |
| 8              | 135                | A     |

# Ganhos com SGBD

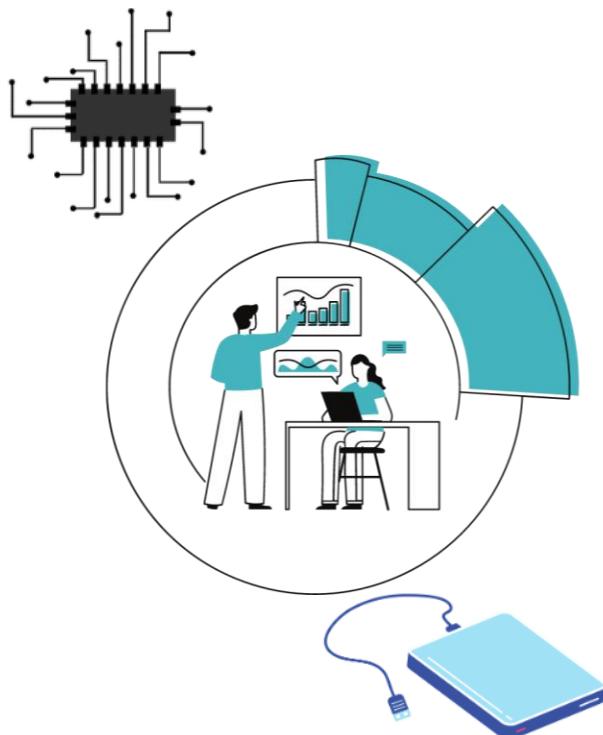


- Padronização
- Redução de tempo no desenvolvimento da aplicacão
- Flexibilidade
- Disponibilidade de info up-to-date
- Economia com escalabilidade

Update imediato



# Ganhos com SGBD



- Padronização
- Redução de tempo no desenvolvimento da aplicação
- Flexibilidade
- Disponibilidade
- Economia de escala

Operacional & Gerenciamento



Consolidação



Overlap

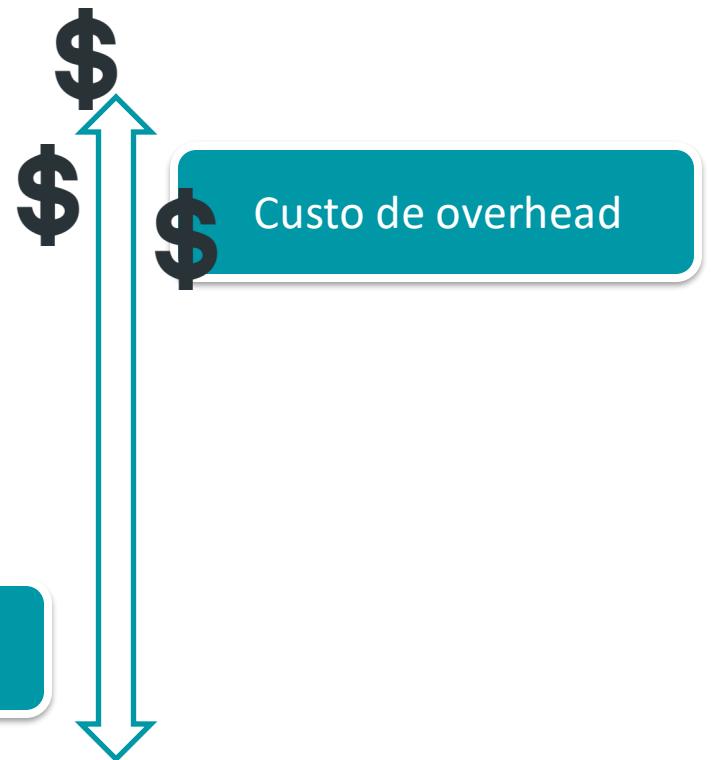
# Quando não usar um SGBD?



# Not use!



Custo-benefício



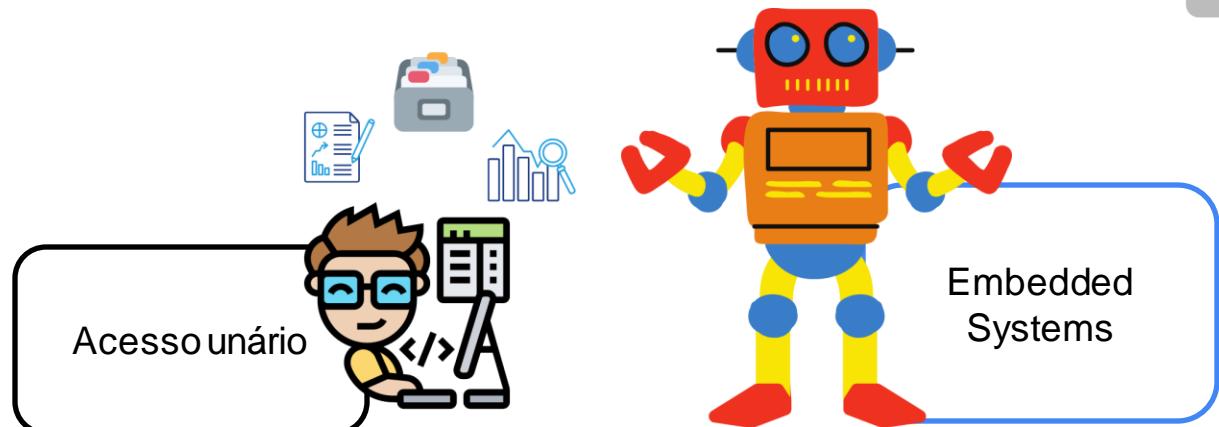
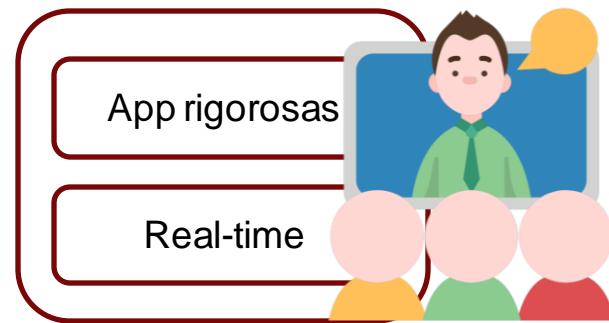
# Not use!



Custo

- Investimento inicial
- Generelidade na definição e processamento
- Segurança, controle de concorrência, recovery, funções de integridade

# Not use!

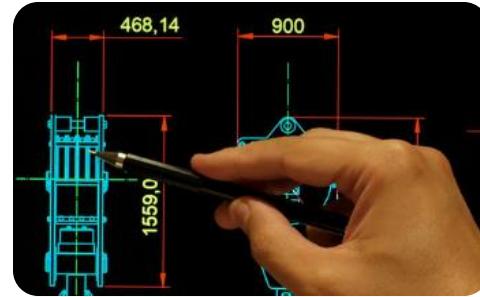


Situações

# Not use!



COMUTAÇÃO



GIS Systems

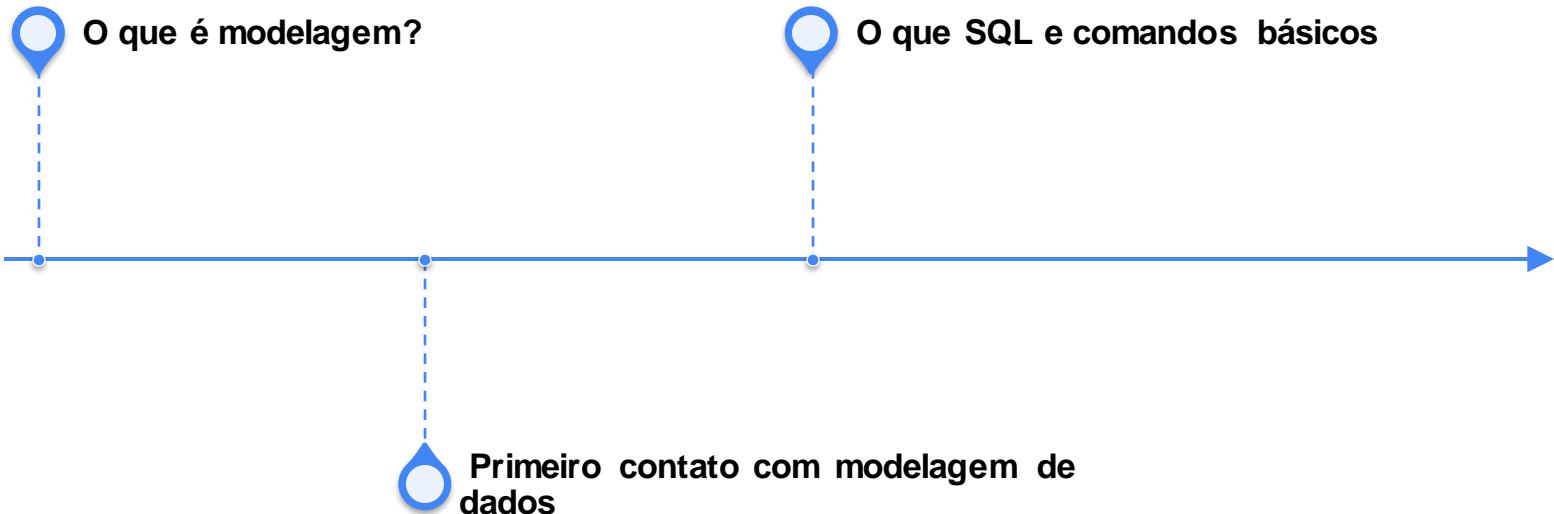


## Etapa 7

# Introdução à Modelagem de Banco de Dados e SQL

// Introdução à Banco e dados

# Conversa



# Por que modelar?



Construção  
Plantas baixa

Desenvolvimento  
Protótipos

Eletrônicos  
Esquema de circuitos



Compreensão do sistema



# Modelagem

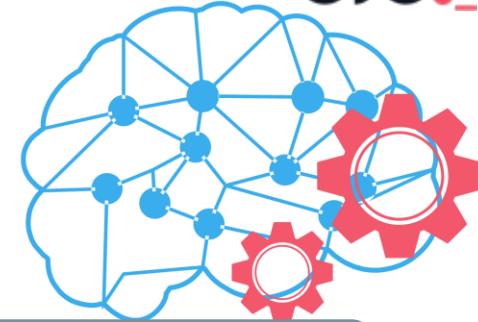


Modelagem

Representação

Modelo

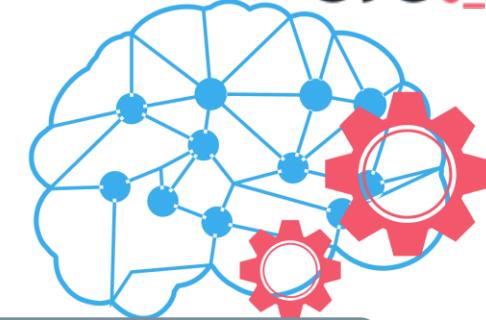
Referência



# Modelagem



Modelagem



Software

Dados

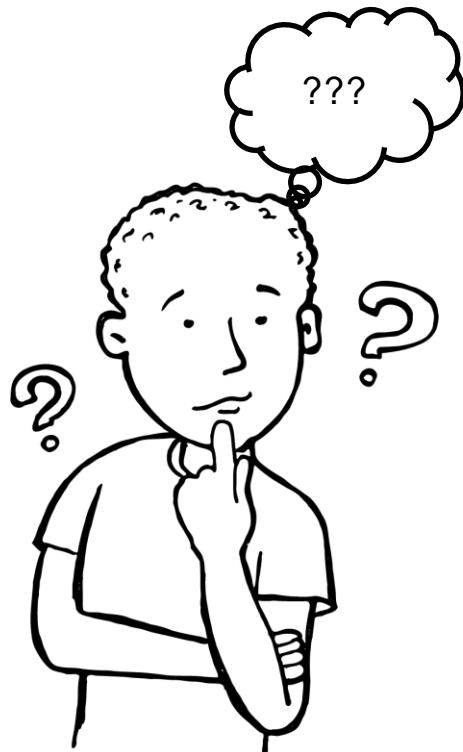
Computacional

Conceitual

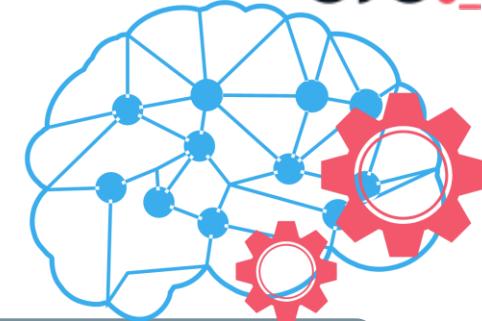
Processo de negócios

Matemática

# Modelagem



Modelagem



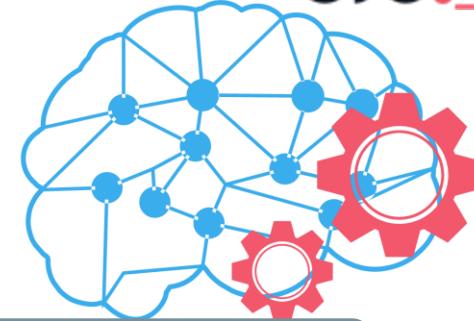
Possui foco na descrição e relacionamento dos elementos que compõem a representação do contexto (mini-mundo)



# Modelagem



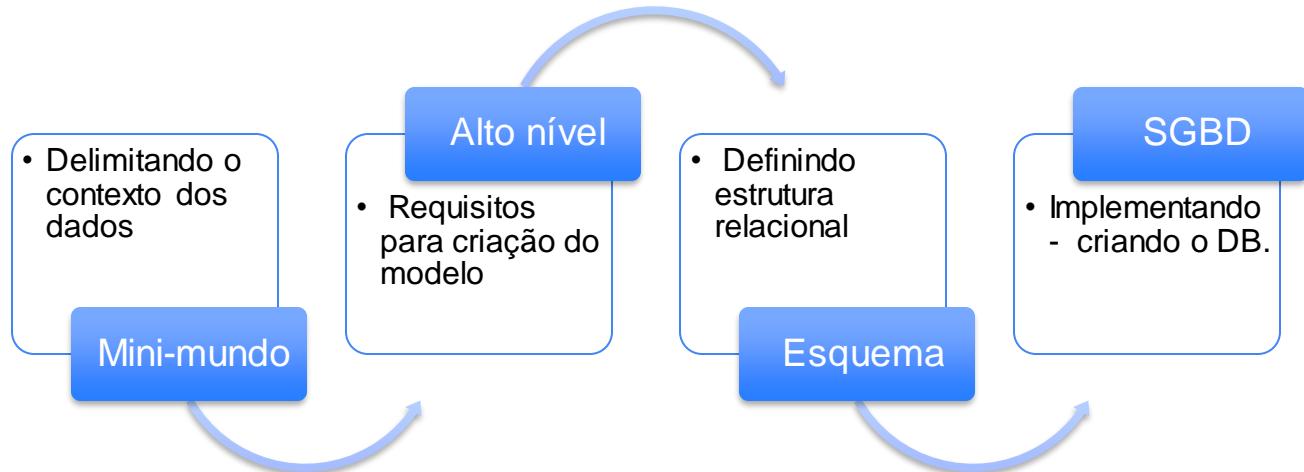
Modelagem



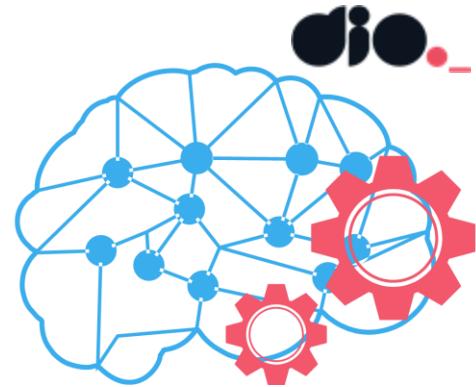
Possui foco na descrição e relacionamento dos elementos que compõem a representação do contexto (mini-mundo)



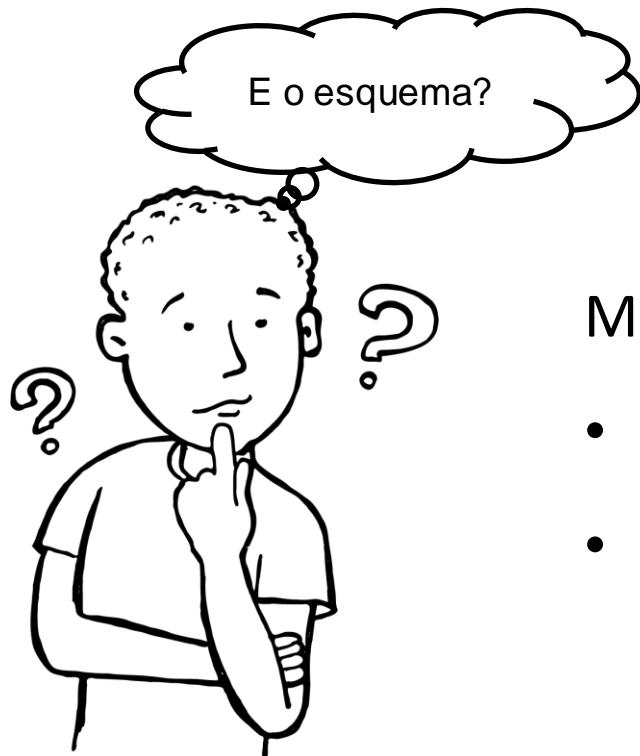
# Modelagem



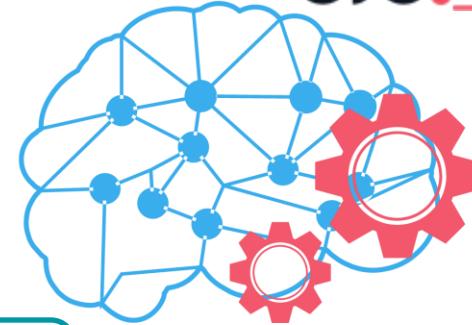
# Modelagem



# Modelagem



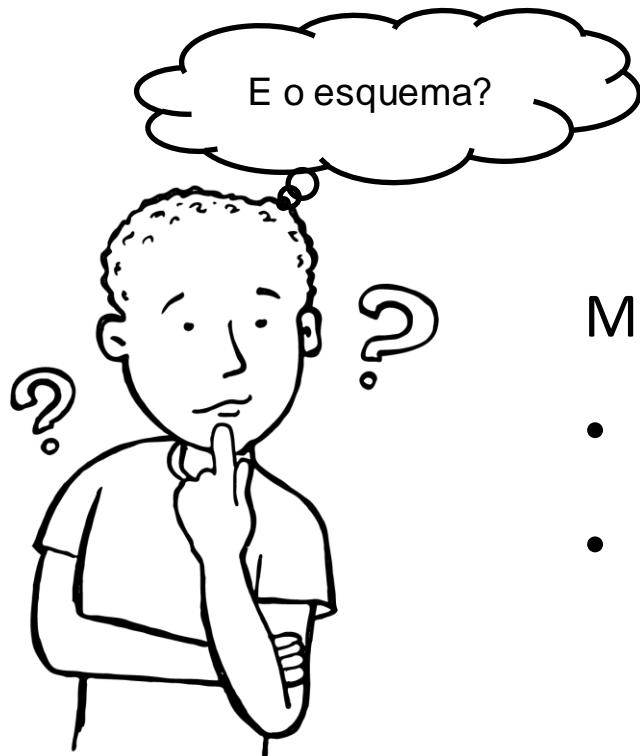
Facilita a compreensão do contexto dos dados



Modelos de alto nível:

- Entidade-Relacionamento
- UML (Unified Modeling Language)

# Modelagem



Facilita a compreensão do contexto dos dados

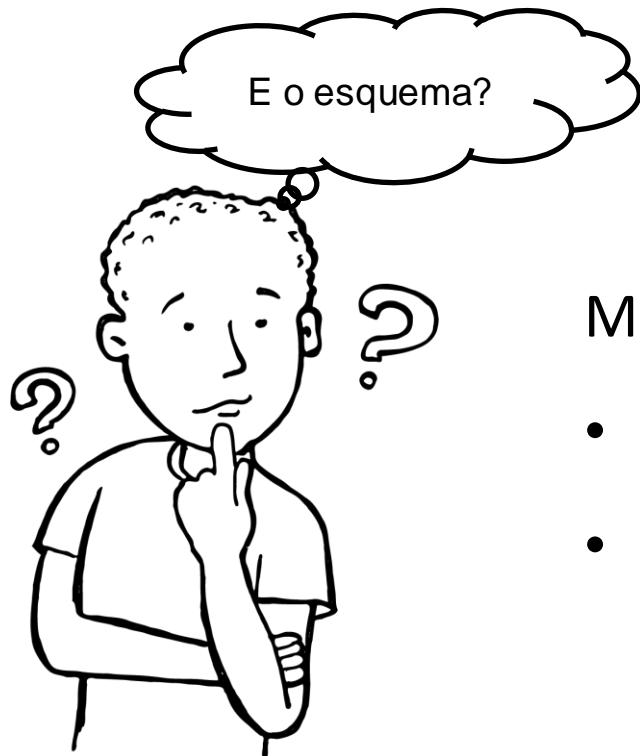
## Modelos de alto nível:

- Entidade-Relacionamento
- UML

Modelos



# Modelagem



Facilita a compreensão do contexto dos dados

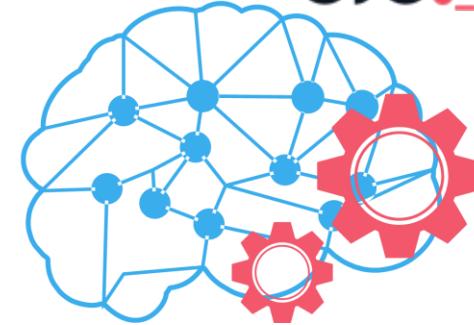
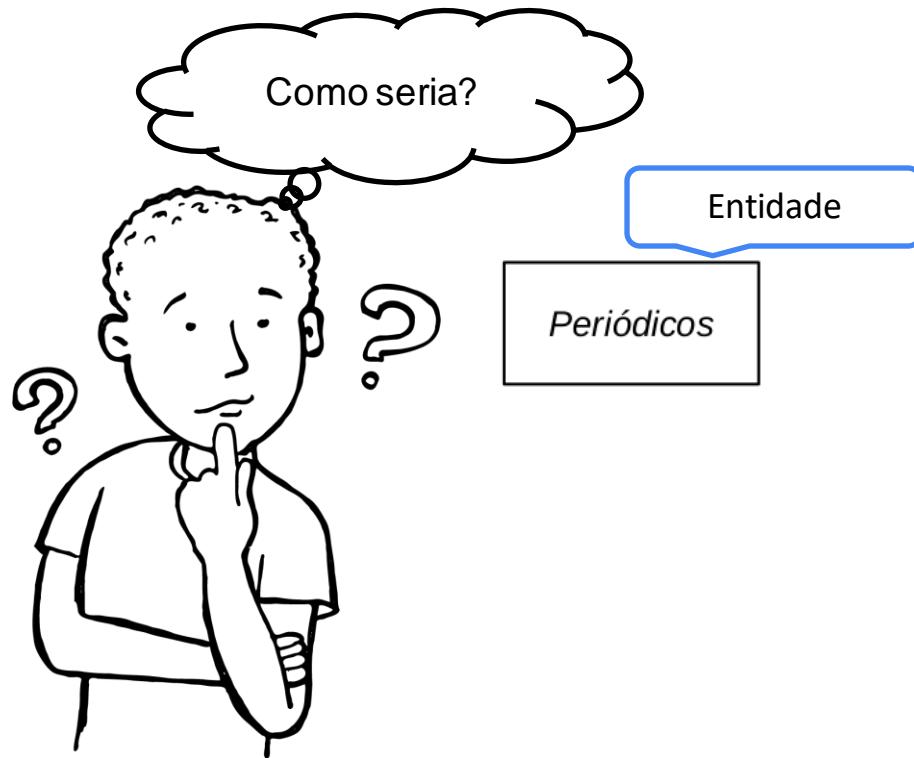
Modelos de alto nível:

- **Entidade-Relacionamento**
- **UML**

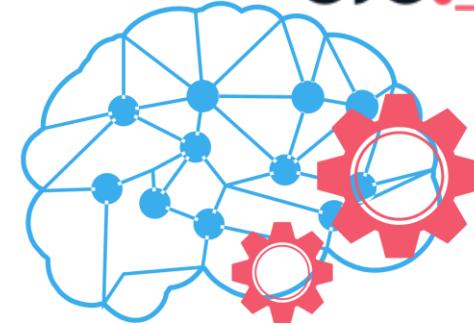
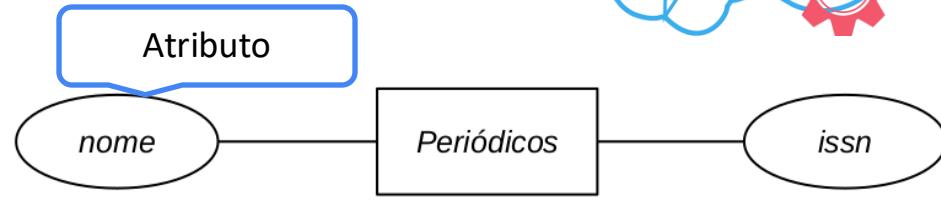
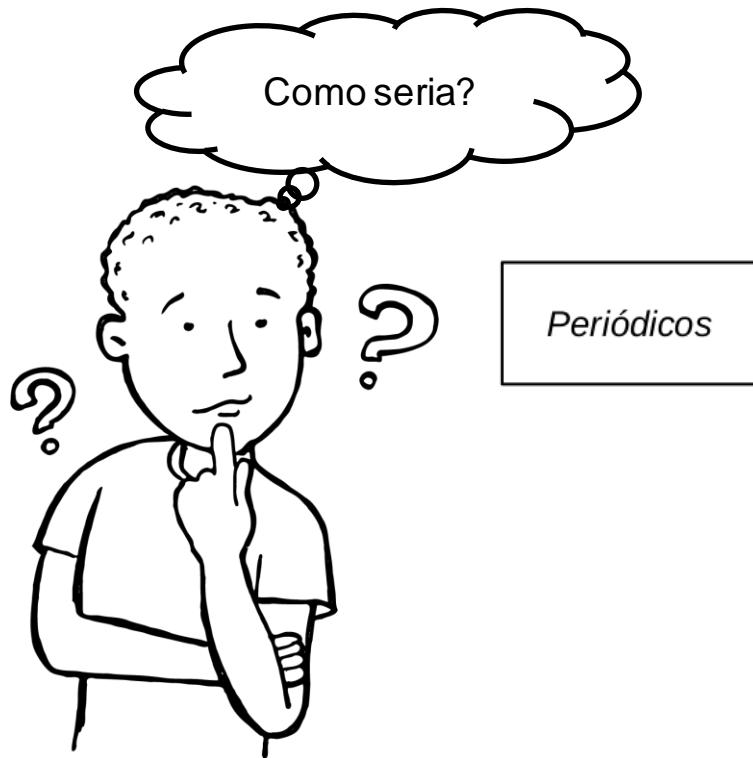
Modelos



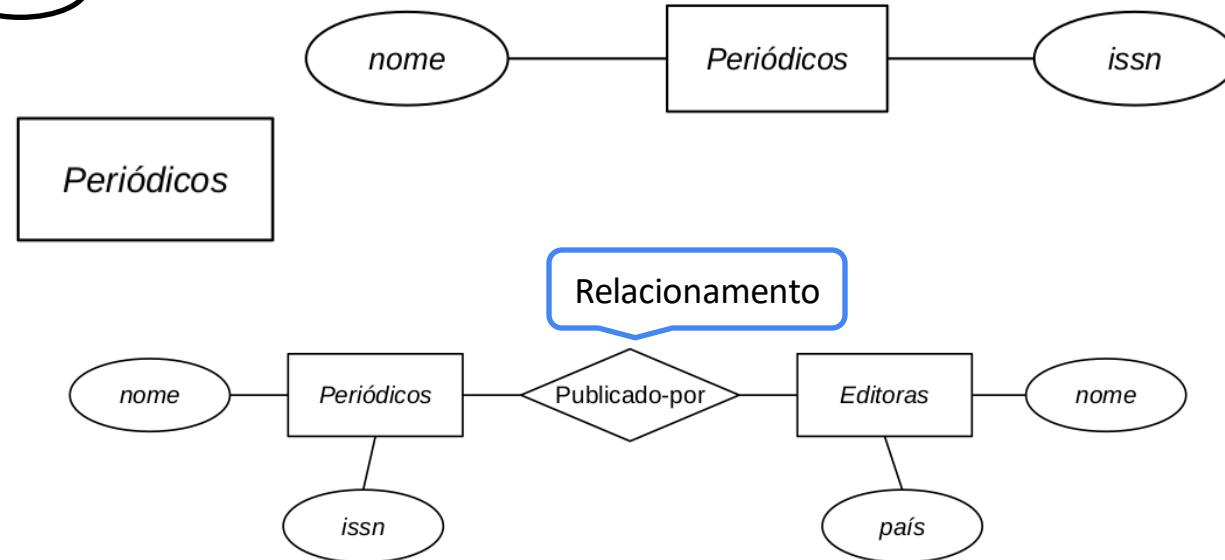
# Modelagem



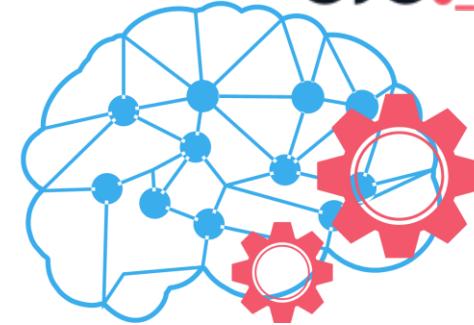
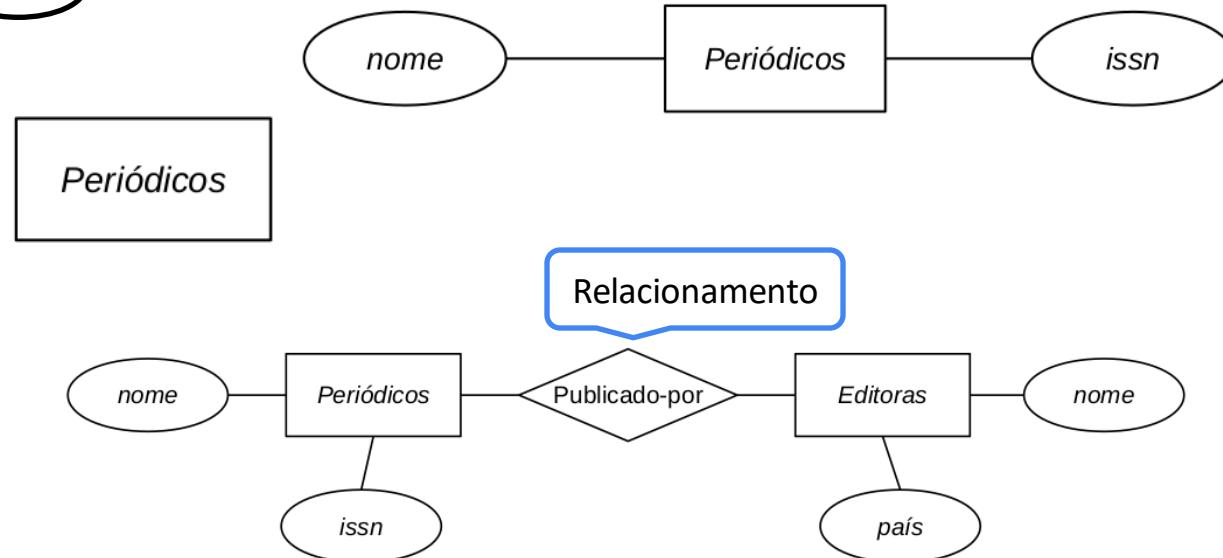
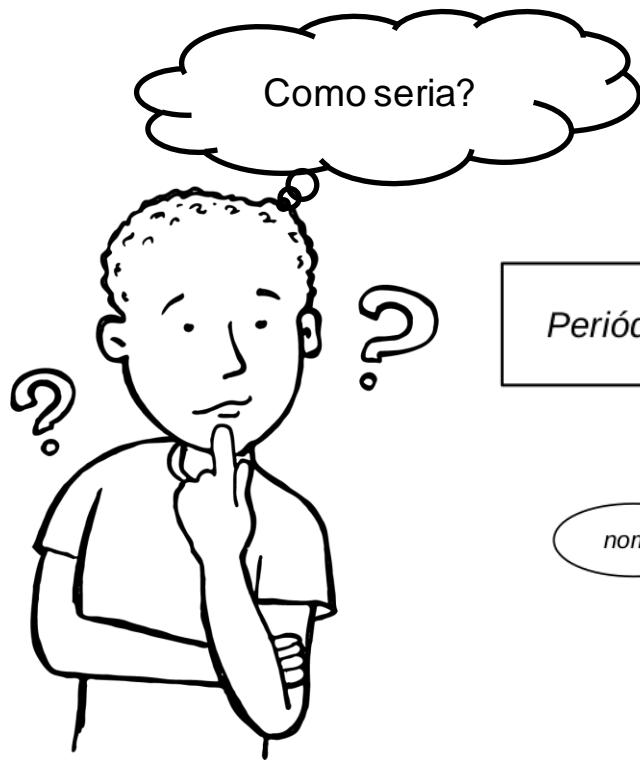
# Modelagem



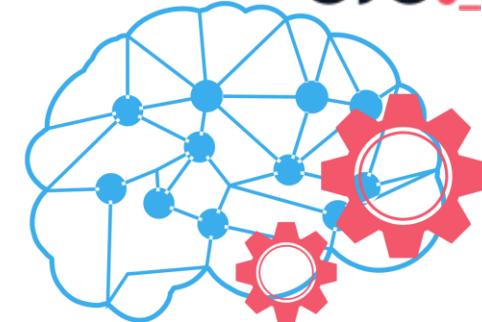
# Modelagem



# Modelagem



# Modelagem



Instâncias

Multiplicidade

Chaves e constraints

Integridade de dados ...

# Modelagem



Facilita a compreensão do contexto dos dados

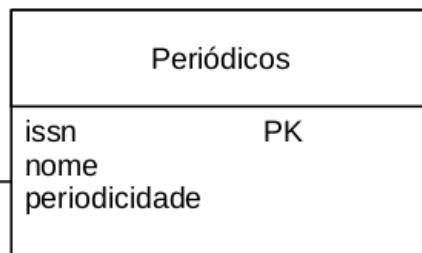
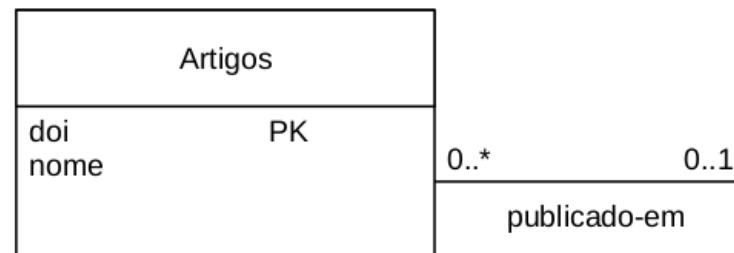
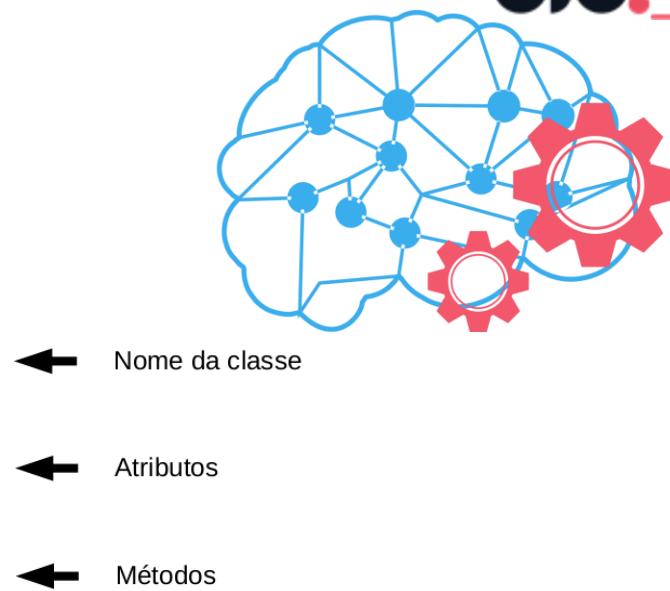
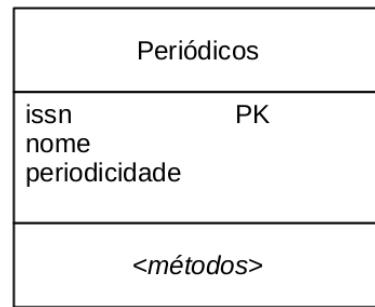
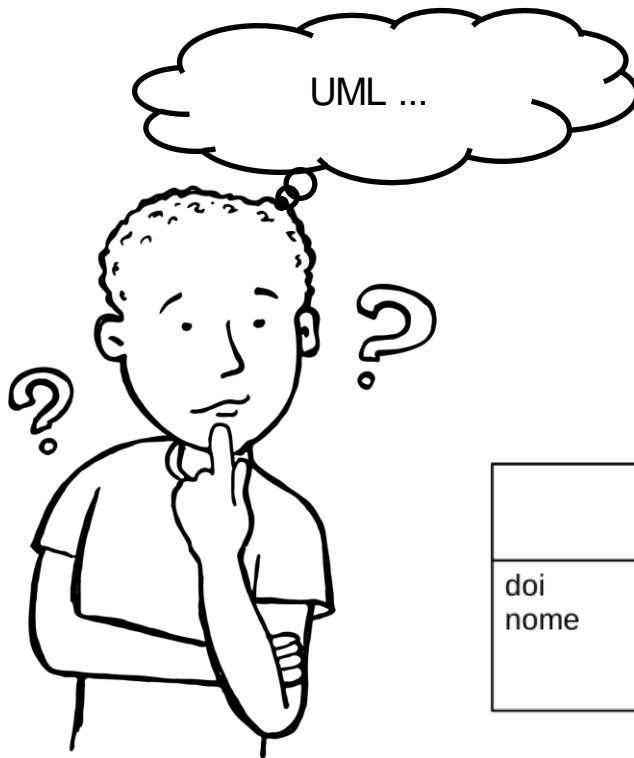
Modelos de alto nível:

- Entidade-Relacionamento
- UML

Modelos



# Modelagem



# Modelagem



CREATE, ALTER, DROP ...

SELECT, INSERT, UPDATE ...



Linguagem declarativa

# SQL – como acessar?

The screenshot shows the phpMyAdmin interface with the following sections visible:

- General Settings:** Shows the MySQL connection selected as "soft\_general".
- Apache module settings:** Includes "Language" set to English, "Timezone" set to "America/Sao\_Paulo", and "Port" set to 80.
- MySQL connections:** Displays MySQL client version 8.0.29 and PHP version 8.0.29.
- MySQL status:** Shows various MySQL server status metrics.
- MySQL processes:** Lists active MySQL processes.

```
jm@jm-HP-G42-Notebook-PC:~$ sudo mysql
[sudo] password for jm:
Welcome to the MySQL monitor. Commands end with ; or \g.
Your MySQL connection id is 8
Server version: 8.0.29-0ubuntu0.20.04.3 (Ubuntu)

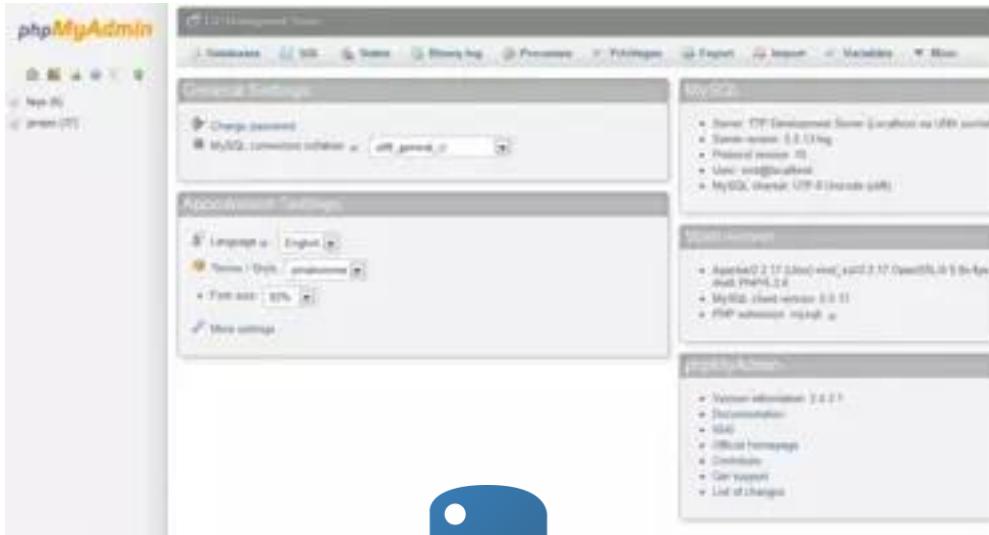
Copyright (c) 2000, 2022, Oracle and/or its affiliates.

Oracle is a registered trademark of Oracle Corporation and/or its
affiliates. Other names may be trademarks of their respective
owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql> 
```

# SQL – como acessar?



```
jm@jm-HP-G42-Notebook-PC: ~
[sudo] password for jm:
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 8
Server version: 8.0.29-0ubuntu0.20.04.3 (Ubuntu)

Copyright (c) 2000, 2022, Oracle and/or its affiliates.

Oracle is a registered trademark of Oracle Corporation and/or its
affiliates. Other names may be trademarks of their respective
owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql> 
```



# SQL – 1º exemplo

```
CREATE DATABASE firstexample;
```

```
CREATE TABLE periodicos(
```

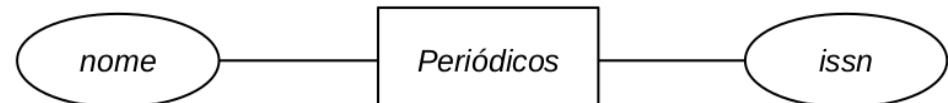
```
    id integer,
```

```
    nome varchar(120),
```

```
    issn integer
```

```
);
```

Criando a tabela periódicos



# SQL – 1º exemplo

```
CREATE DATABASE firstexample;
```

```
CREATE TABLE periodicos(
```

```
    id integer,
```

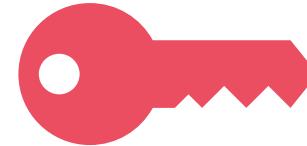
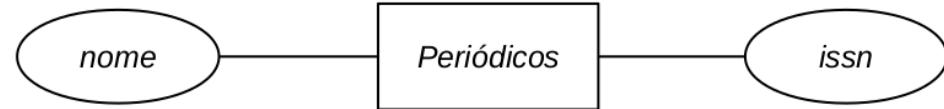
```
    nome varchar
```

```
    issn :
```

Como garantir unicidade?

```
);
```

Criando a tabela periódicos



Primary Key

# SQL – 1º exemplo

```
CREATE DATABASE firstexample;
```

```
CREATE TABLE periodicos(
```

```
    id integer,
```

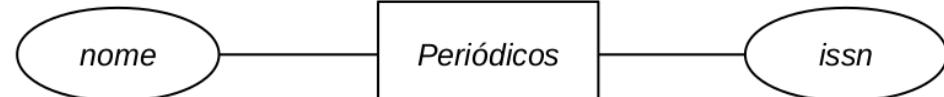
```
    nome varchar(120),
```

```
    issn integer,
```

```
    PRIMARY KEY (id)
```

```
);
```

Criando a tabela periódicos



Primary Key



# SQL – 1º exemplo

```
CREATE TABLE editora(
```

```
    id integer,
```

```
    nome_editora varchar(120),
```

```
    País integer,
```

```
    PRIMARY KEY (id)
```

```
);
```

Criando a tabela editoras



# SQL – 1º exemplo

```
CREATE TABLE periodicos(
```

```
    id integer,
```

```
    nome varchar(120),
```

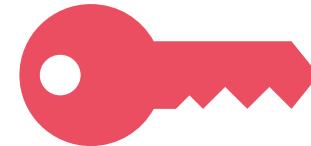
```
    issn integer,
```

```
    PRIMARY KEY (id),
```

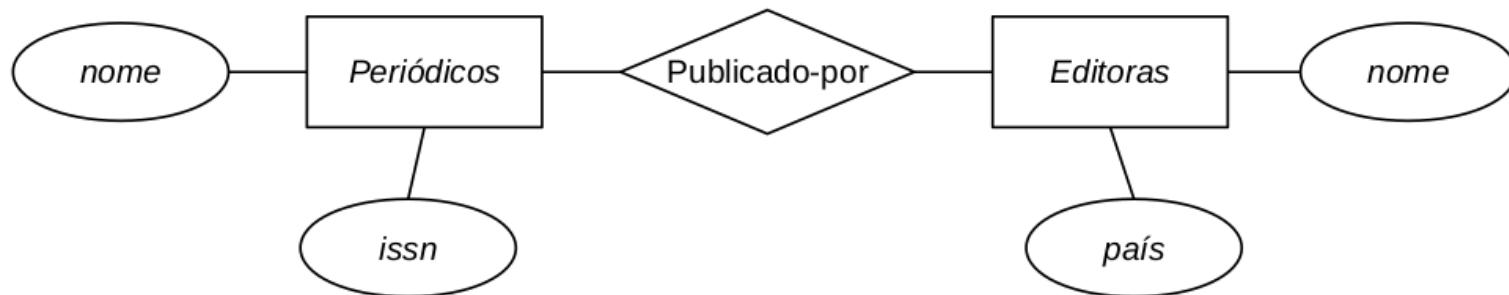
```
    FOREIGN KEY (id) REFERENCES editora(id)
```

```
);
```

Definindo relacionamento



# Desafio



## Etapa 8

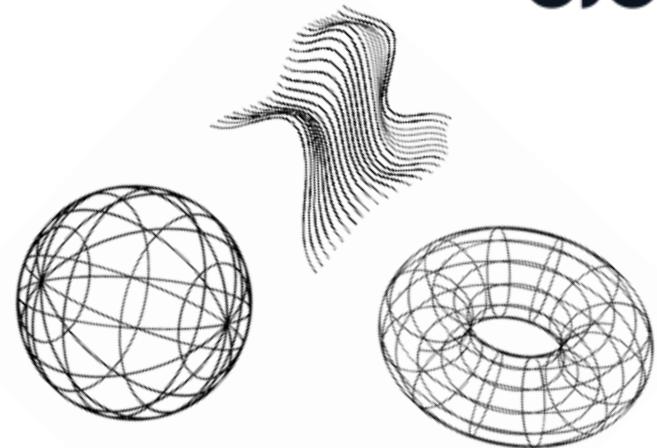
# Arquitetura: Modelos, Esquemas e Instâncias

// Introdução à Banco de dados

# Conversa



# Modelo

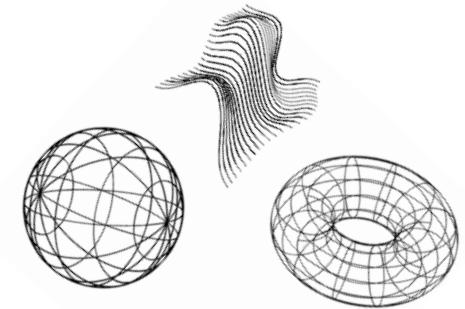
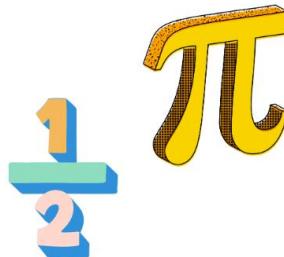


Abstração



essencial

# Modelo



Data model

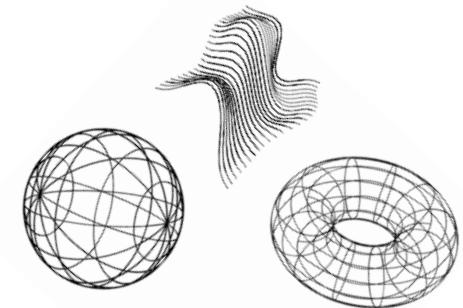
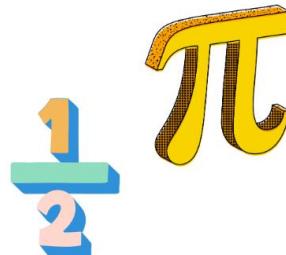


Abstração



essencial

# Modelo



Operações



Data model

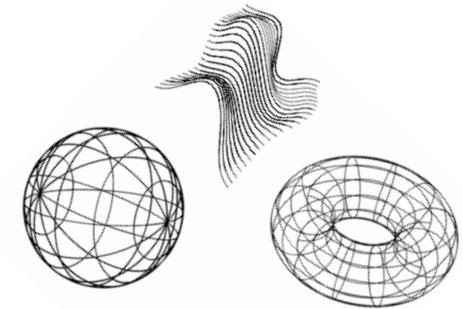
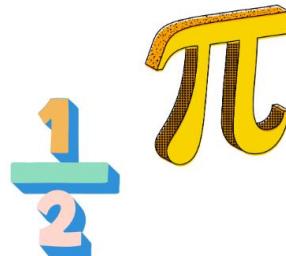


Abstração



essencial

# Modelo



Operações



Data model



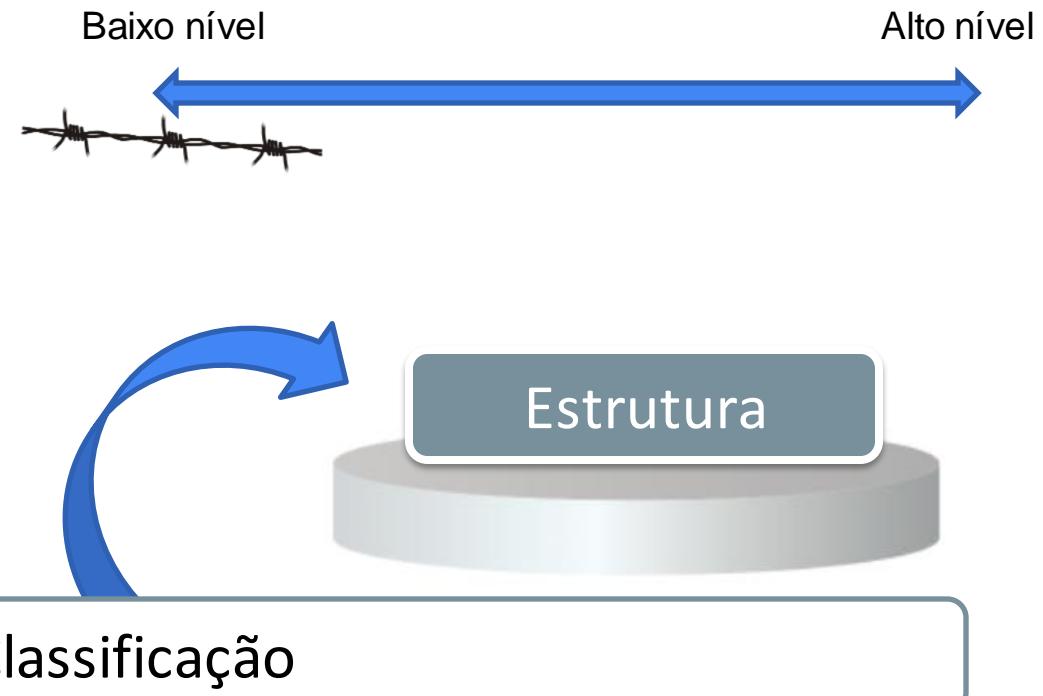
Classificação

Abstração

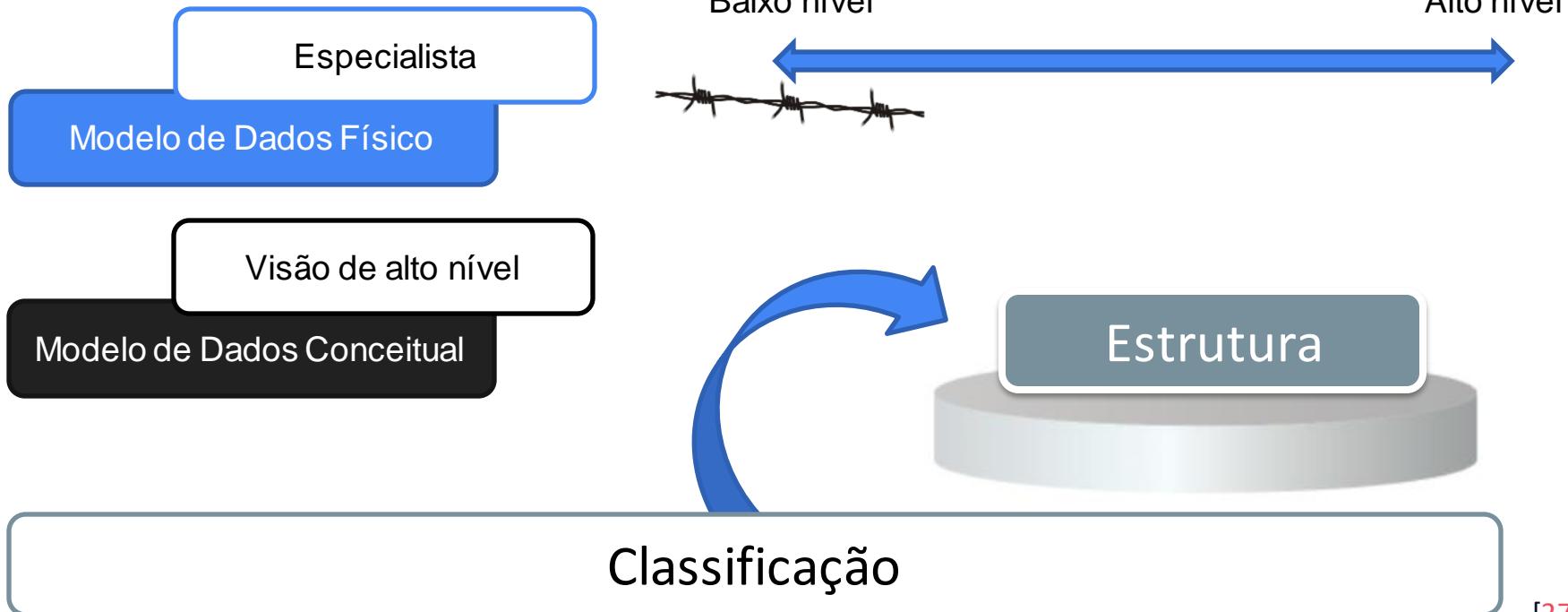


essencial

# Modelo



# Modelo



# Modelo

Especialista  
Modelo de Dados Físico

Visão de alto nível  
Modelo de Dados Conceitual

Classificação

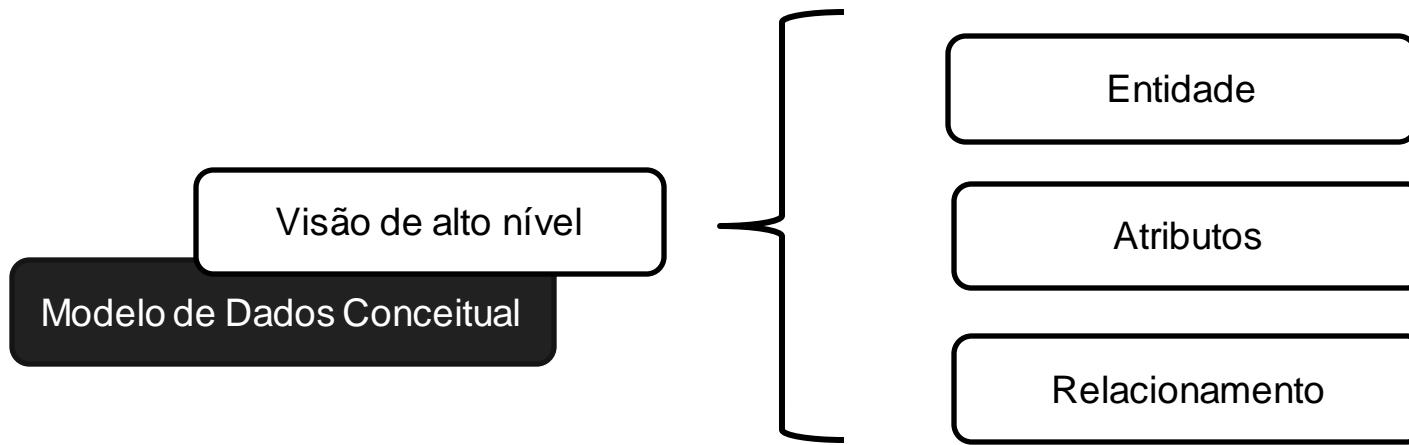


Representacional  
Modelo de Dados de implementação



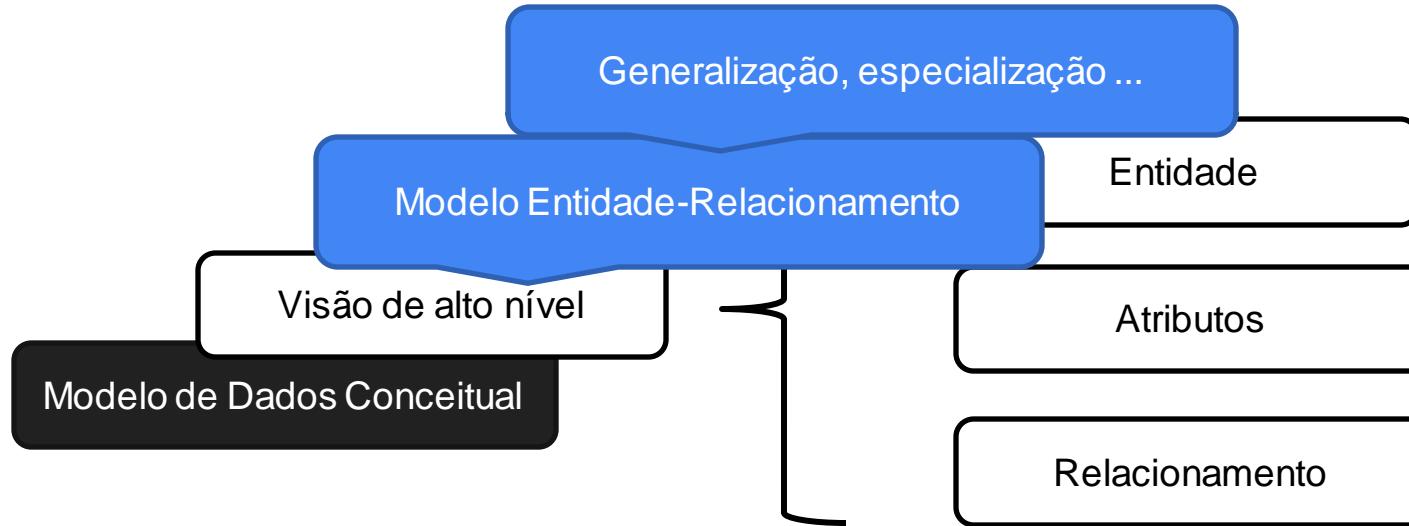
Estrutura

# Modelo



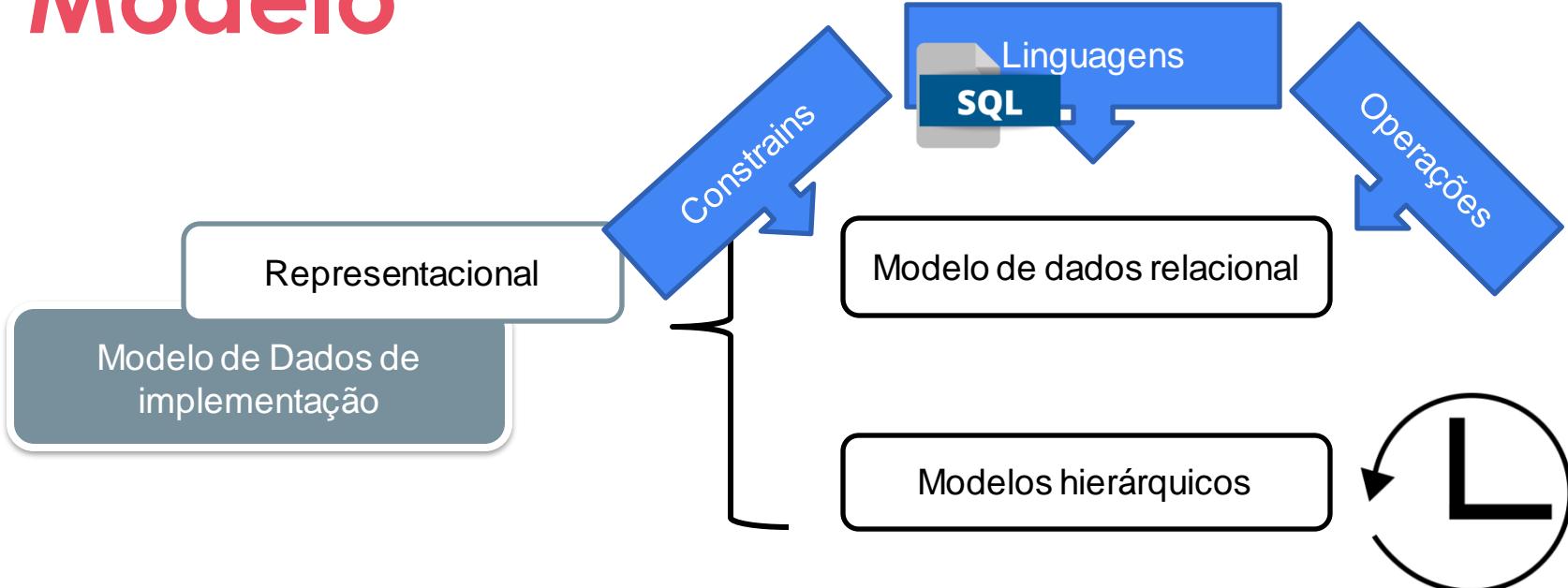
Classificação

# Modelo



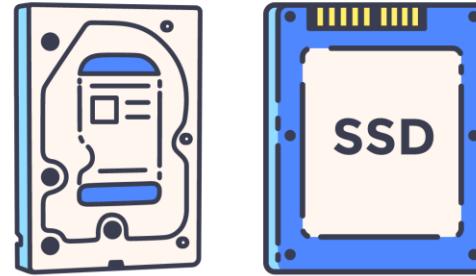
Classificação

# Modelo



Classificação

# Modelo



Modelo de Dados Físico

Especialista

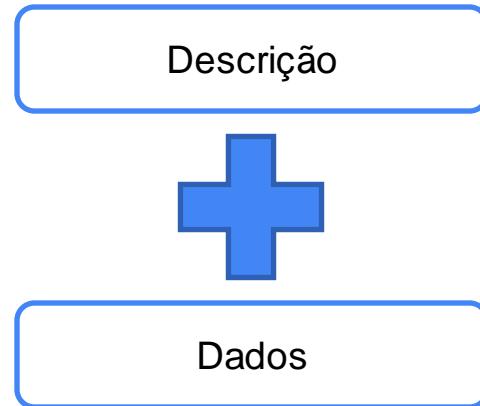


.CSV

Classificação

# Modelo

Modelo de Dados  
Auto-descritivo



**XML**

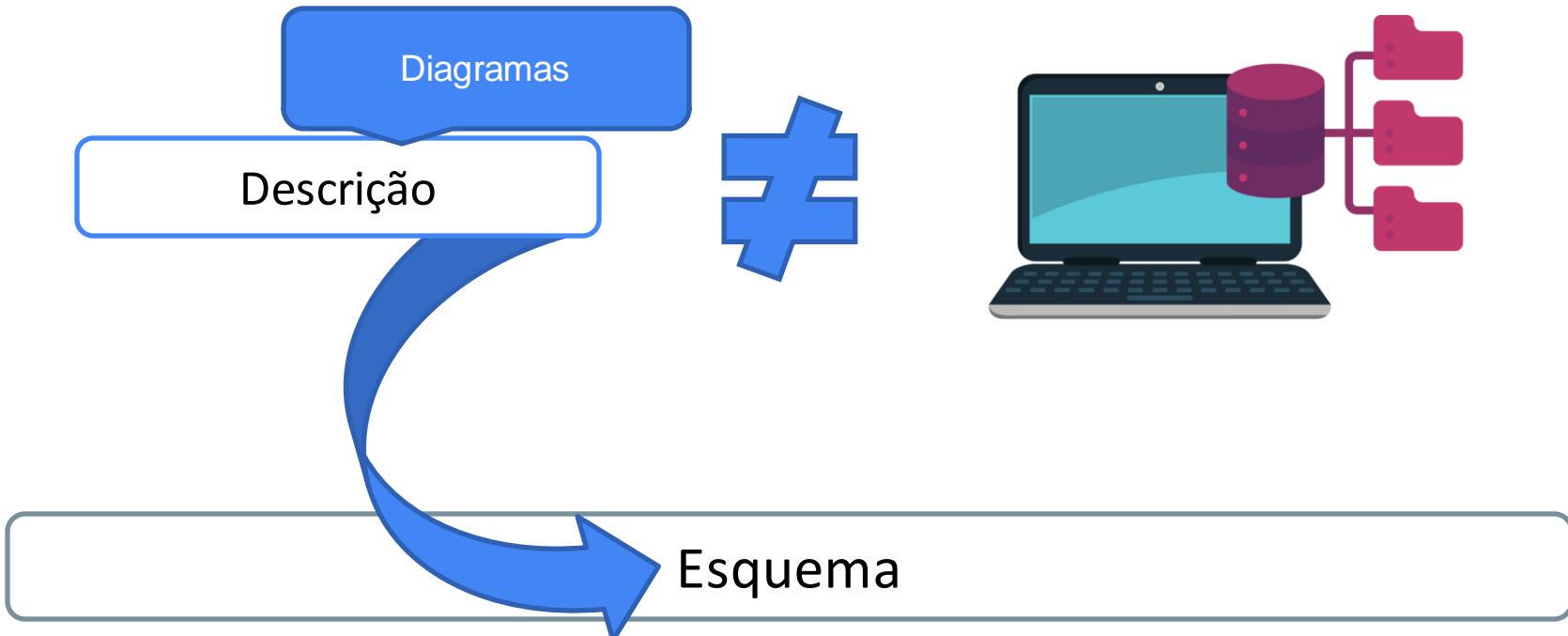
**KEY-VALUE**

Classificação

# Esquemas, Instâncias e Estados do BD



# Esquema



# Esquema

Diagramas

Descrição

## STUDENT

|      |                |       |       |
|------|----------------|-------|-------|
| Name | Student_number | Class | Major |
|------|----------------|-------|-------|

## COURSE

|             |               |              |            |
|-------------|---------------|--------------|------------|
| Course_name | Course_number | Credit_hours | Department |
|-------------|---------------|--------------|------------|

## PREREQUISITE

|               |                     |
|---------------|---------------------|
| Course_number | Prerequisite_number |
|---------------|---------------------|

## SECTION

|                    |               |          |      |            |
|--------------------|---------------|----------|------|------------|
| Section_identifier | Course_number | Semester | Year | Instructor |
|--------------------|---------------|----------|------|------------|

## GRADE\_REPORT

|                |                    |       |
|----------------|--------------------|-------|
| Student_number | Section_identifier | Grade |
|----------------|--------------------|-------|

Esquema

# Esquema

Diagrams

Descrição

Construct

STUDENT

|      |                |       |       |
|------|----------------|-------|-------|
| Name | Student_number | Class | Major |
|------|----------------|-------|-------|

COURSE

|             |               |              |            |
|-------------|---------------|--------------|------------|
| Course_name | Course_number | Credit_hours | Department |
|-------------|---------------|--------------|------------|

PREREQUISITE

|               |                     |
|---------------|---------------------|
| Course_number | Prerequisite_number |
|---------------|---------------------|

SECTION

|                    |               |          |      |            |
|--------------------|---------------|----------|------|------------|
| Section_identifier | Course_number | Semester | Year | Instructor |
|--------------------|---------------|----------|------|------------|

GRADE\_REPORT

|                |                    |       |
|----------------|--------------------|-------|
| Student_number | Section_identifier | Grade |
|----------------|--------------------|-------|

Esquema

# Esquema

Diagrams

Descrição

Tipos de dados & Itens

Construct

STUDENT

|      |                |       |       |
|------|----------------|-------|-------|
| Name | Student_number | Class | Major |
|------|----------------|-------|-------|

COURSE

|             |               |              |            |
|-------------|---------------|--------------|------------|
| Course_name | Course_number | Credit_hours | Department |
|-------------|---------------|--------------|------------|

PREREQUISITE

|               |                     |
|---------------|---------------------|
| Course_number | Prerequisite_number |
|---------------|---------------------|

SECTION

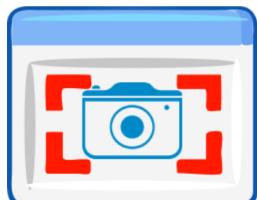
|                    |               |          |      |            |
|--------------------|---------------|----------|------|------------|
| Section_identifier | Course_number | Semester | Year | Instructor |
|--------------------|---------------|----------|------|------------|

GRADE\_REPORT

|                |                    |       |
|----------------|--------------------|-------|
| Student_number | Section_identifier | Grade |
|----------------|--------------------|-------|

Esquema

# Snapshot



Dados mudam

Instância | Ocorrência

## STUDENT

|      |                |       |       |
|------|----------------|-------|-------|
| Name | Student_number | Class | Major |
|------|----------------|-------|-------|

## COURSE

|             |               |              |            |
|-------------|---------------|--------------|------------|
| Course_name | Course_number | Credit_hours | Department |
|-------------|---------------|--------------|------------|

## PREREQUISITE

|               |                     |
|---------------|---------------------|
| Course_number | Prerequisite_number |
|---------------|---------------------|

## SECTION

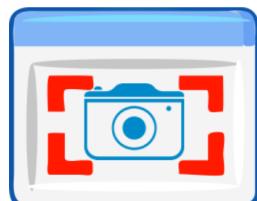
|                    |               |          |      |            |
|--------------------|---------------|----------|------|------------|
| Section_identifier | Course_number | Semester | Year | Instructor |
|--------------------|---------------|----------|------|------------|

## GRADE\_REPORT

|                |                    |       |
|----------------|--------------------|-------|
| Student_number | Section_identifier | Grade |
|----------------|--------------------|-------|

Esquema

# Snapshot



Dados mudam

Instância | Ocorrência

Esquema

## STUDENT

|      |                |       |       |
|------|----------------|-------|-------|
| Name | Student_number | Class | Major |
|------|----------------|-------|-------|

## COURSE

|             |               |          |          |            |
|-------------|---------------|----------|----------|------------|
| Course_name | Course_number | Offering | Capacity | Department |
|-------------|---------------|----------|----------|------------|

## PREREQUISITE

|               |                     |
|---------------|---------------------|
| Course_number | Prerequisite_number |
|---------------|---------------------|

## SECTION

|                    |               |          |      |            |
|--------------------|---------------|----------|------|------------|
| Section_identifier | Course_number | Semester | Year | Instructor |
|--------------------|---------------|----------|------|------------|

## GRADE\_REPORT

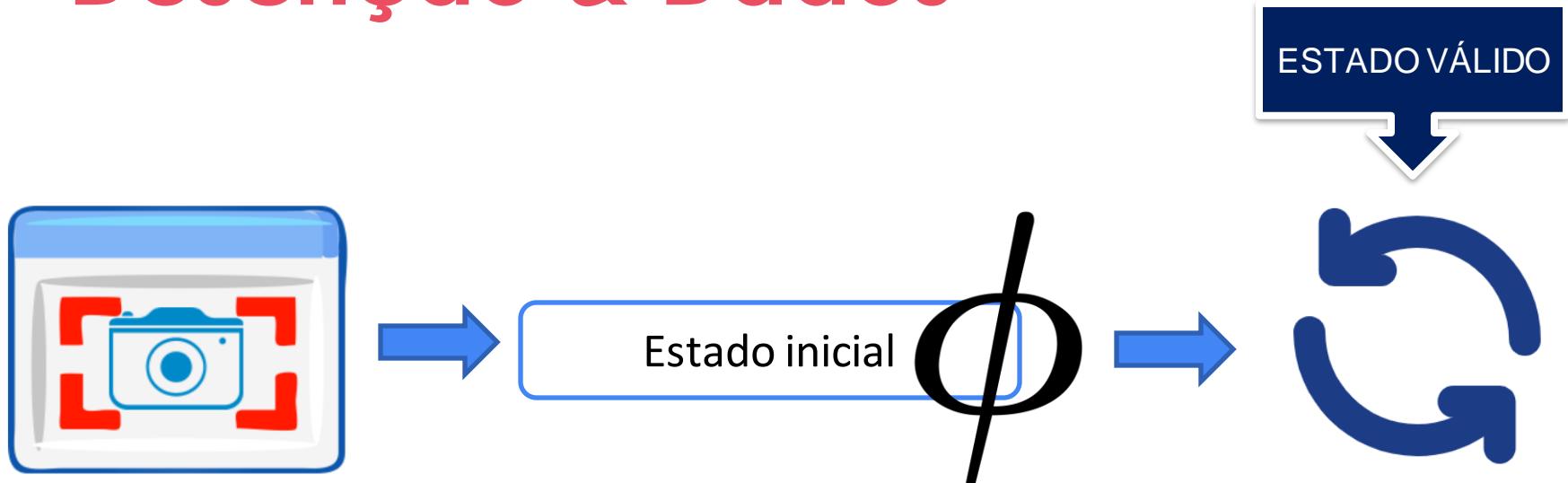
|                |       |
|----------------|-------|
| Student_number | Score |
|----------------|-------|

Insert, Delete

Mudança de estado

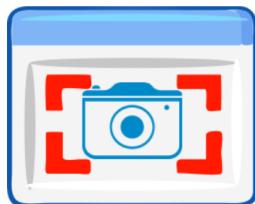
Update

# Descrição & Dados



Esquema

# Snapshot



Dados mudam

Mudança = evolução

## STUDENT

|      |                |       |       |
|------|----------------|-------|-------|
| Name | Student_number | Class | Major |
|------|----------------|-------|-------|

## COURSE

|             |               |              |            |
|-------------|---------------|--------------|------------|
| Course_name | Course_number | Credit_hours | Department |
|-------------|---------------|--------------|------------|

## PREREQUISITE

|               |                     |
|---------------|---------------------|
| Course_number | Prerequisite_number |
|---------------|---------------------|

## SECTION

|                    |               |          |      |            |
|--------------------|---------------|----------|------|------------|
| Section_identifier | Course_number | Semester | Year | Instructor |
|--------------------|---------------|----------|------|------------|

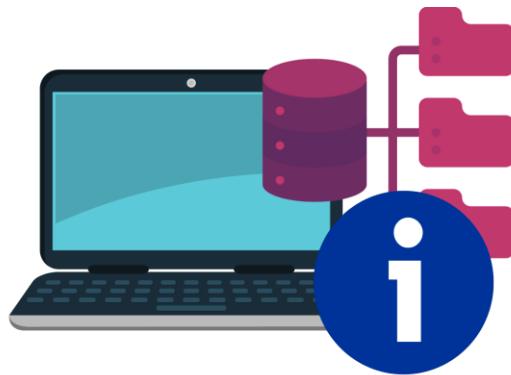
## GRADE\_REPORT

|                |                    |       |
|----------------|--------------------|-------|
| Student_number | Section_identifier | Grade |
|----------------|--------------------|-------|

Instância | Ocorrência

Esquema

# Meta dados



Descrição esquema

Construtores

Constrains



Esquema

# Three-Schema Architecture



# Three-Schema

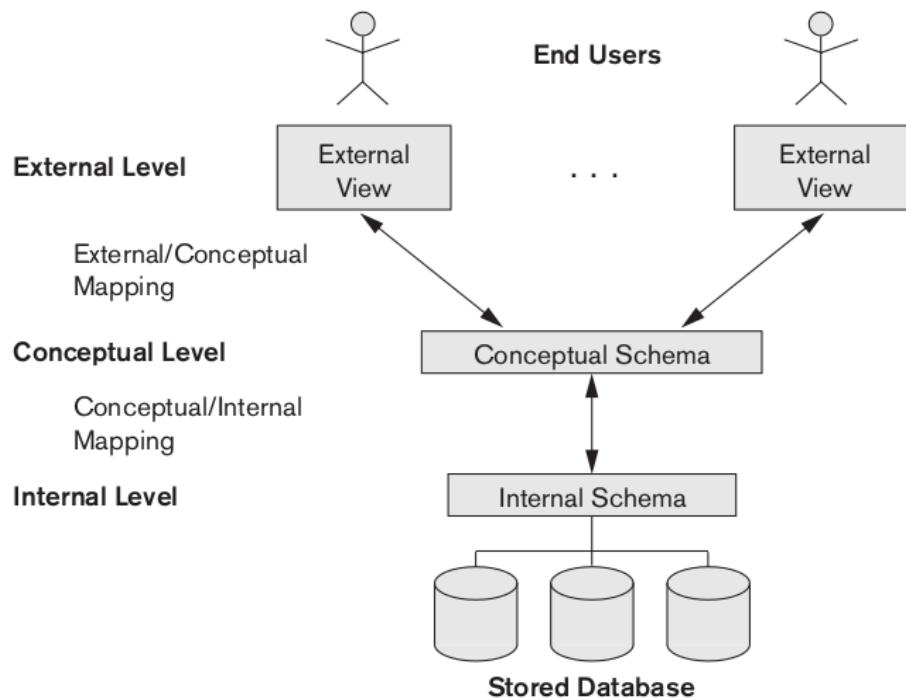
Catálogo

Isolamento  
data/program

Views

Esquema

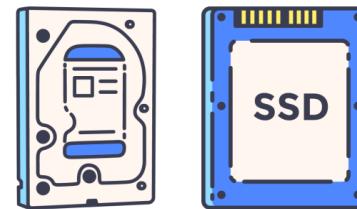
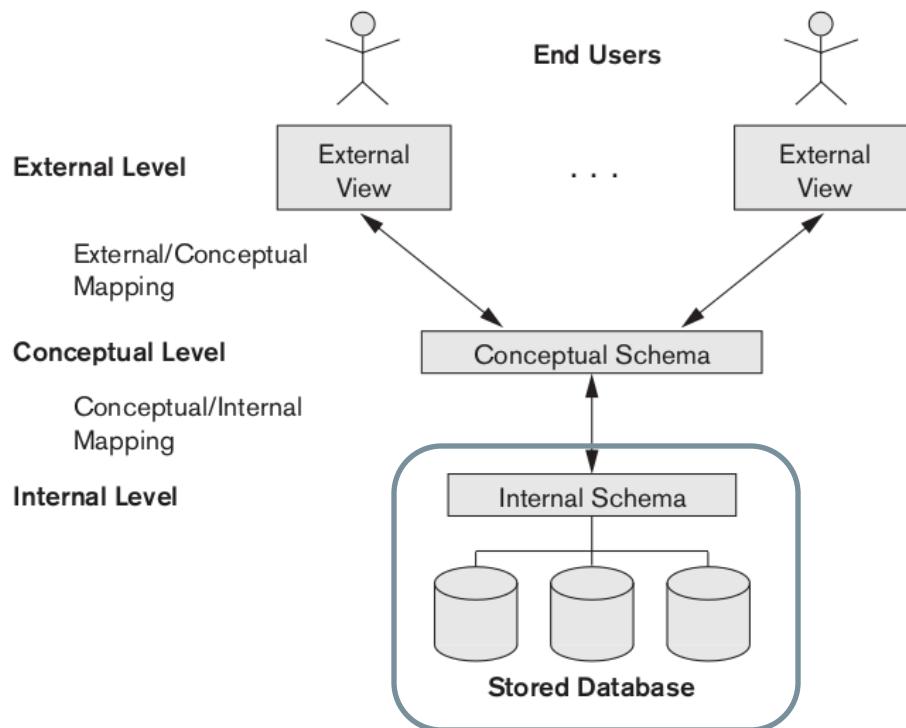
# Arquitetura



Aplicações de Usuário

Físico BD

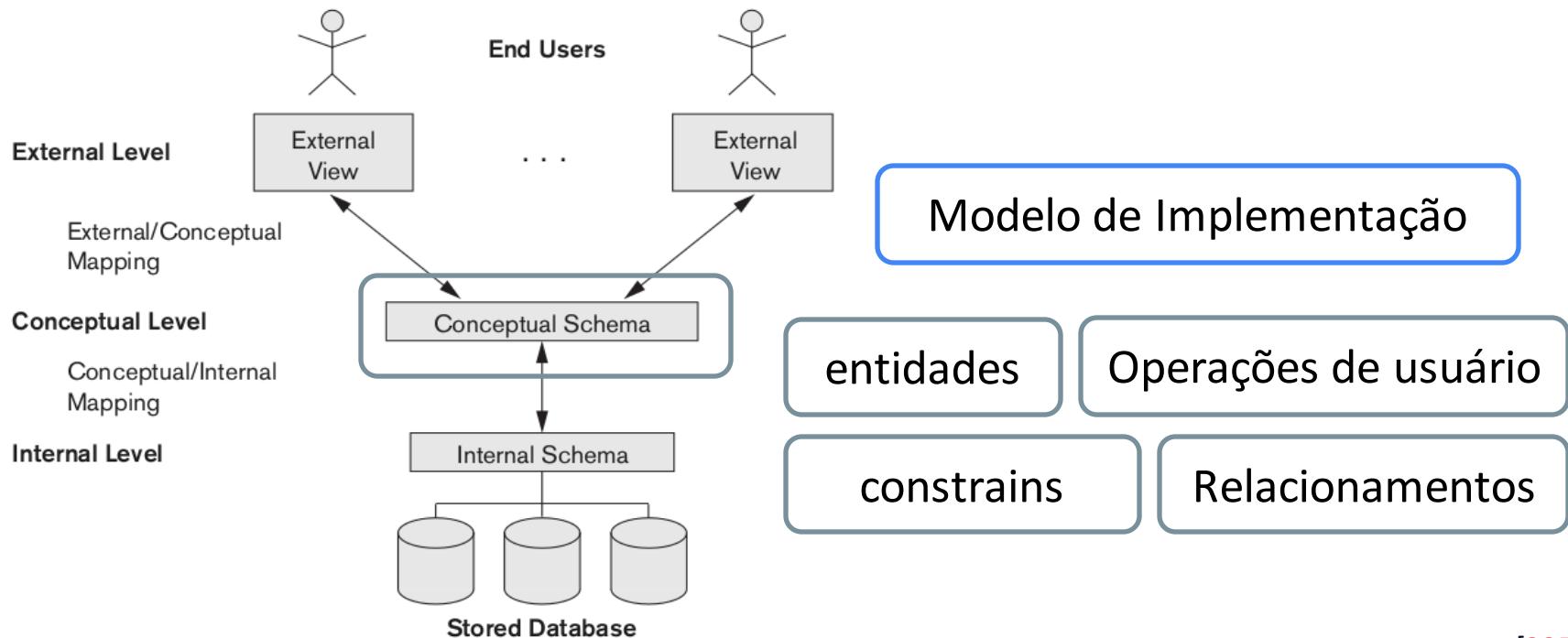
# Arquitetura



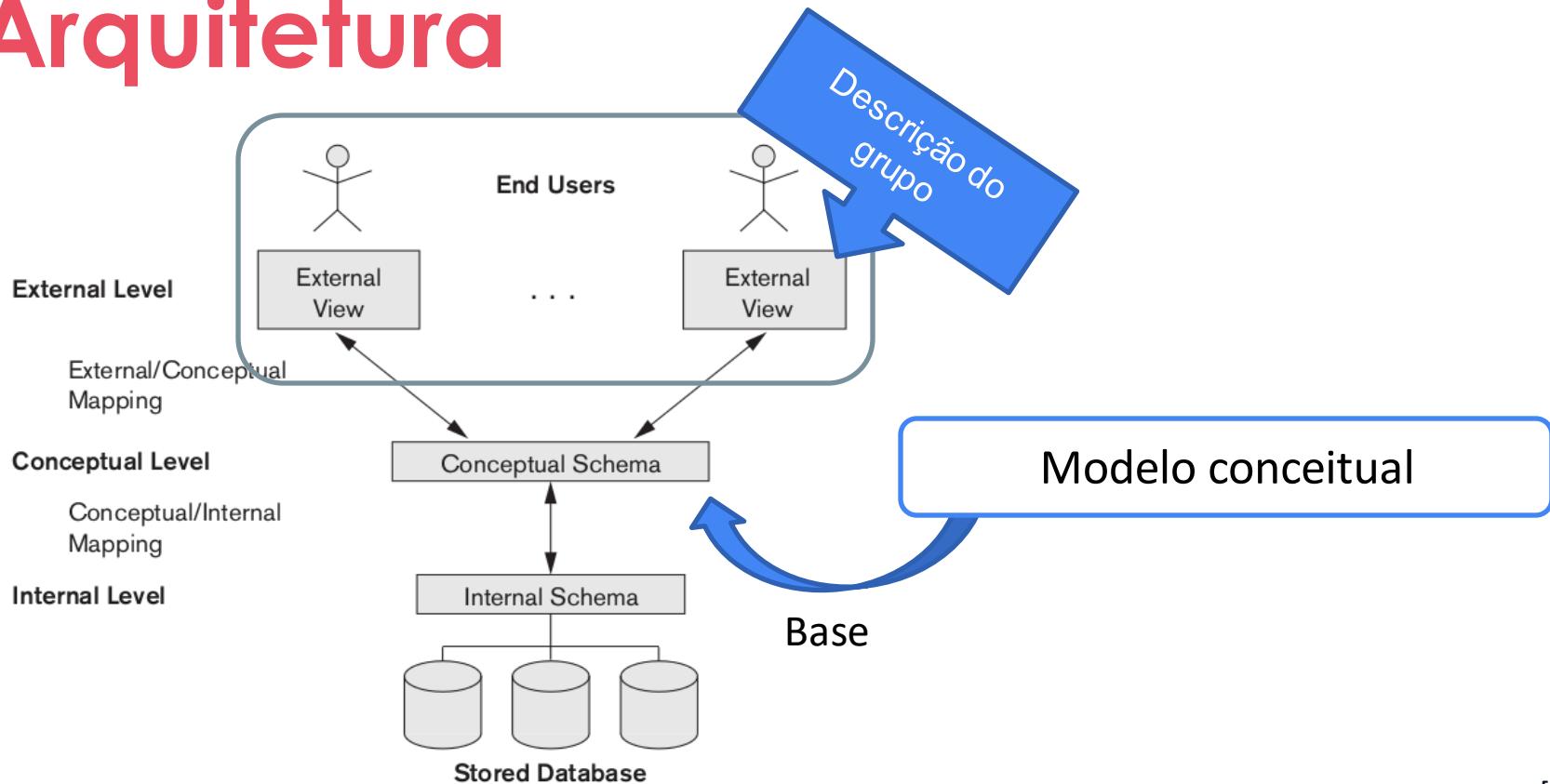
Modelo de dados físico



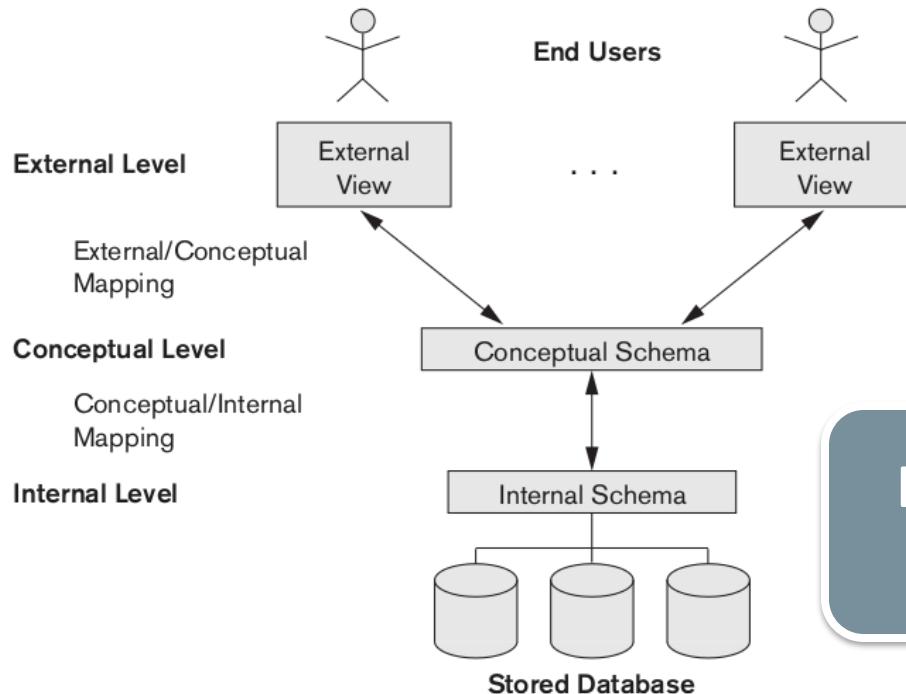
# Arquitetura



# Arquitetura



# Arquitetura



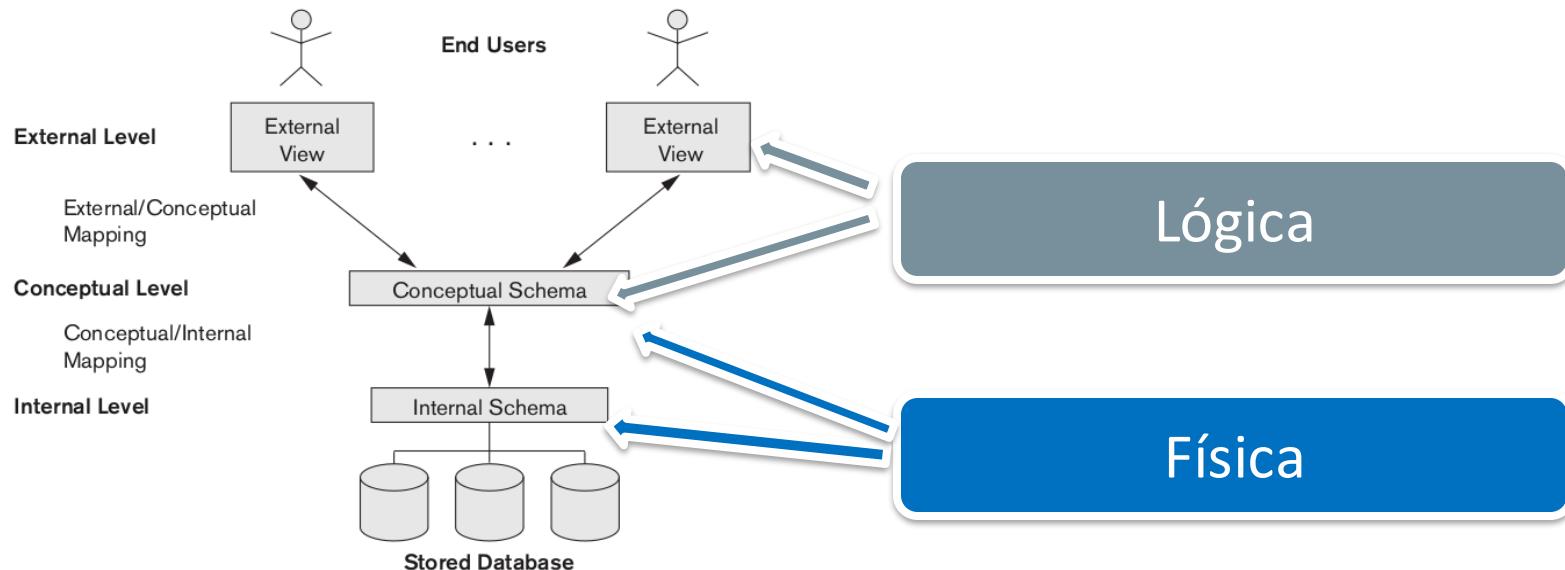
Explicitamente

NOT

Completamente

Desenvolvimento e Design  
do sistema

# Independência de dados

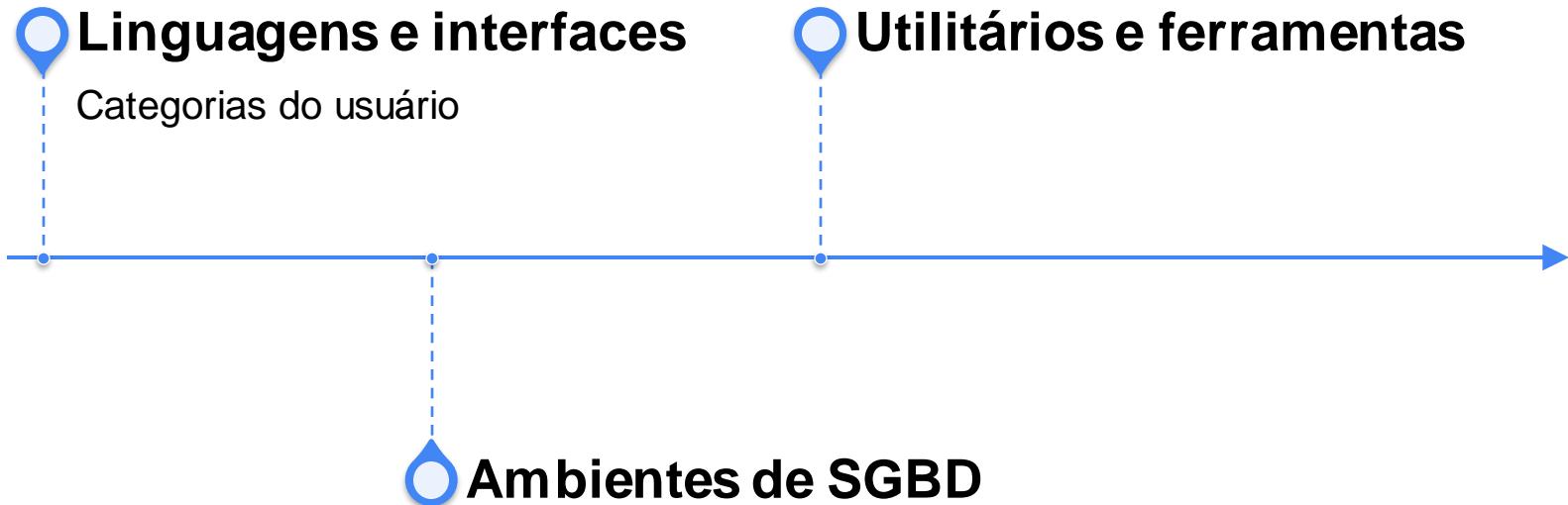


## Etapa 9

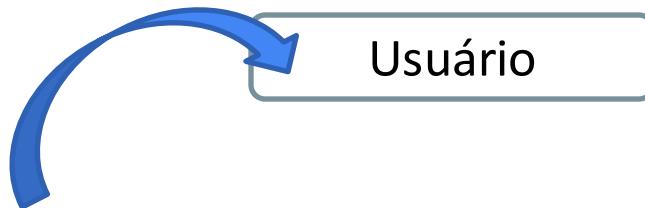
# Arquitetura: Linguagem, Interface e Ambiente de SGBDs

// Introdução à Banco de dados

# Conversa



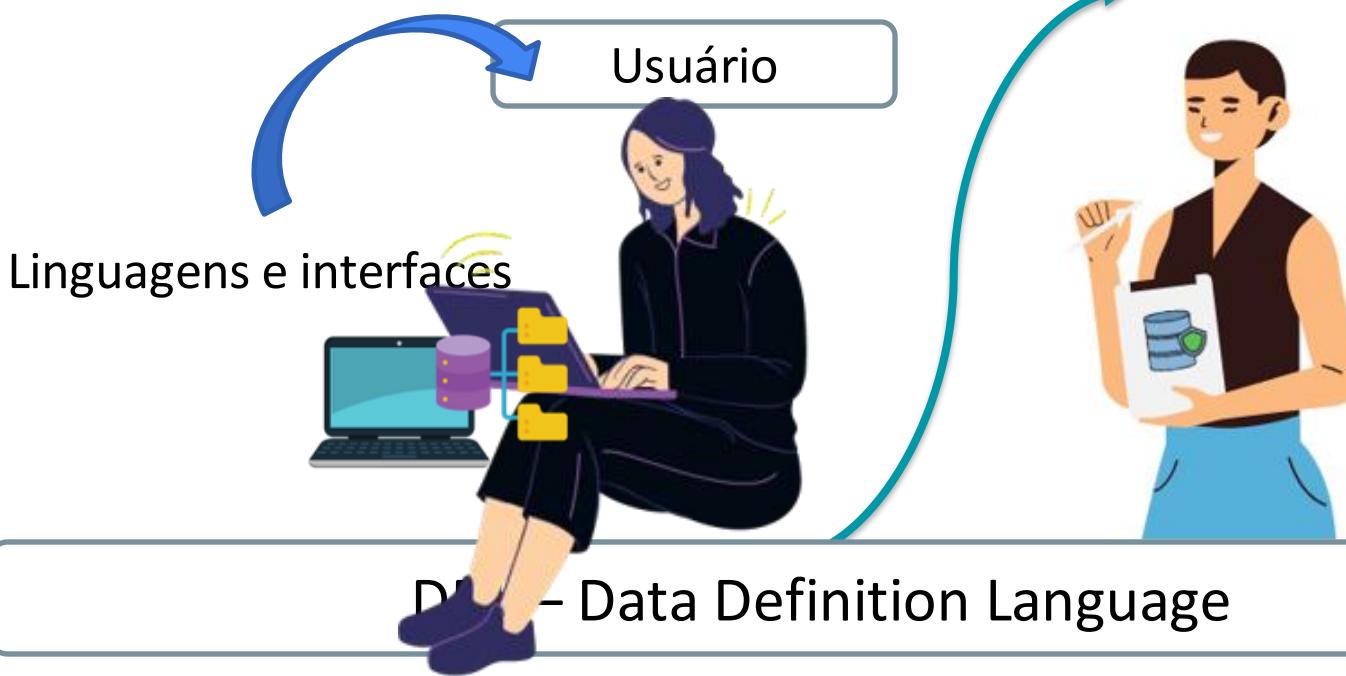
# Linguagens



Linguagens e interfaces

DDL – Data Definition Language

# Linguagens



## STUDENT

|      |                |       |       |
|------|----------------|-------|-------|
| Name | Student_number | Class | Major |
|------|----------------|-------|-------|

## COURSE

|             |               |              |            |
|-------------|---------------|--------------|------------|
| Course_name | Course_number | Credit_hours | Department |
|-------------|---------------|--------------|------------|

## PREREQUISITE

|               |                     |
|---------------|---------------------|
| Course_number | Prerequisite_number |
|---------------|---------------------|

## SECTION

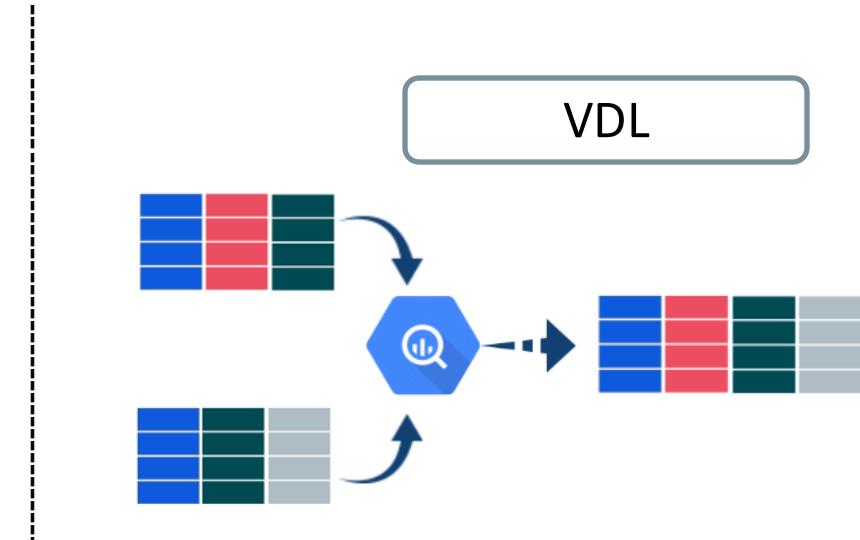
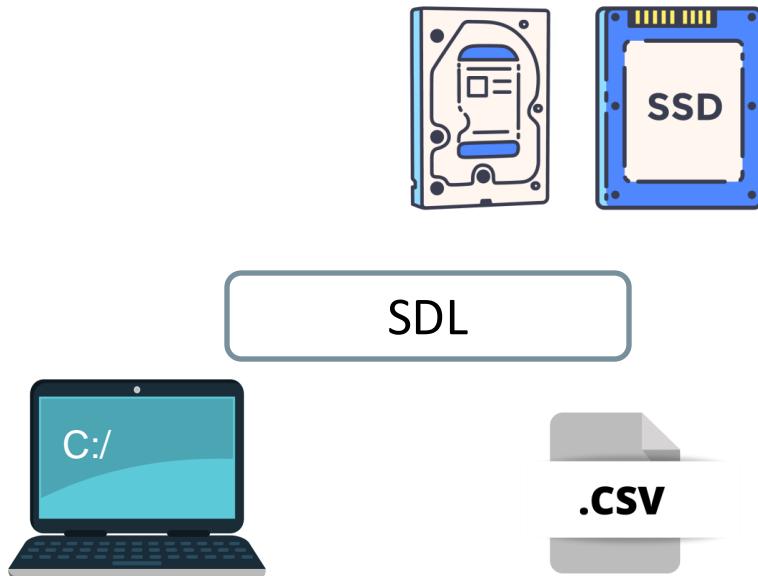
|                    |               |          |      |            |
|--------------------|---------------|----------|------|------------|
| Section_identifier | Course_number | Semester | Year | Instructor |
|--------------------|---------------|----------|------|------------|

## GRADE\_REPORT

|                |                    |       |
|----------------|--------------------|-------|
| Student_number | Section_identifier | Grade |
|----------------|--------------------|-------|

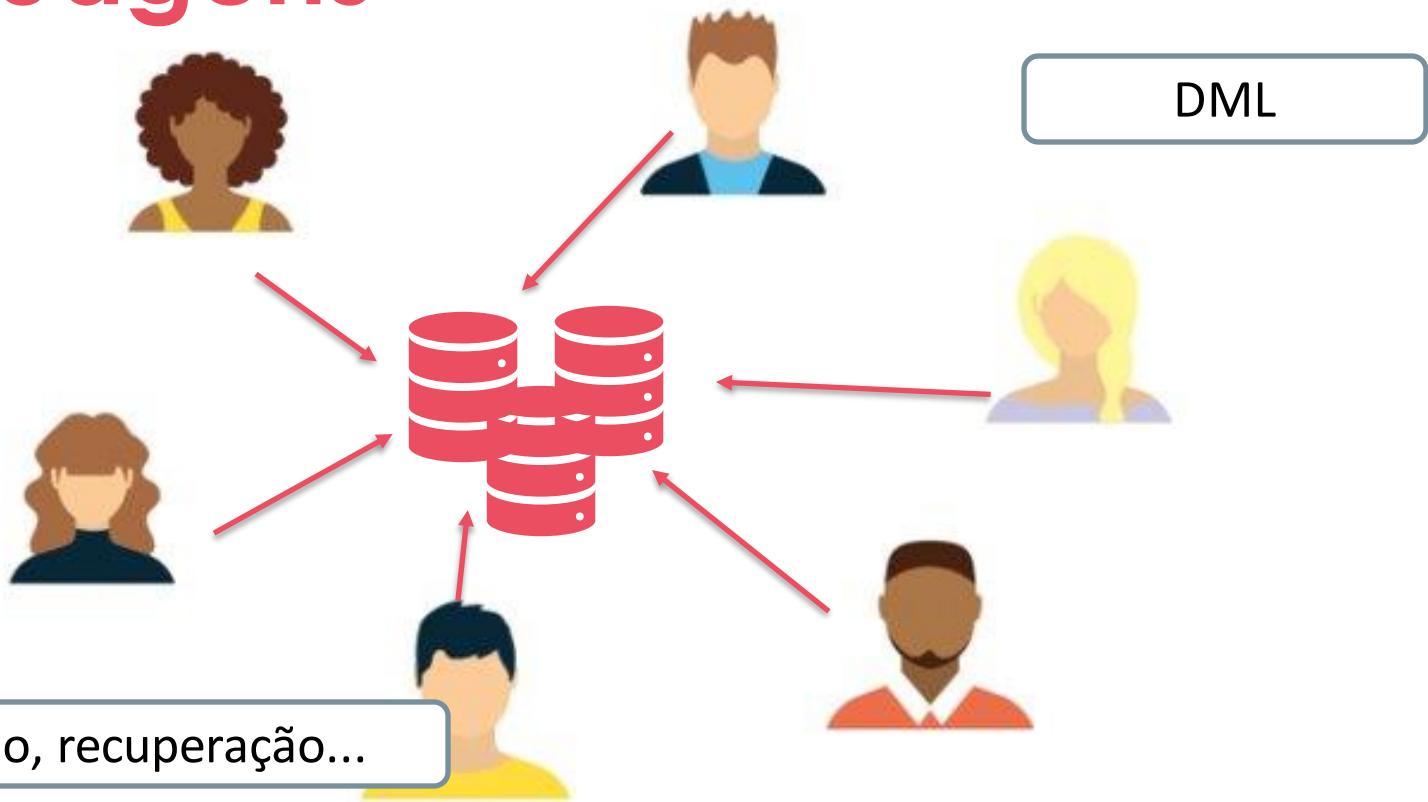


# Linguagens

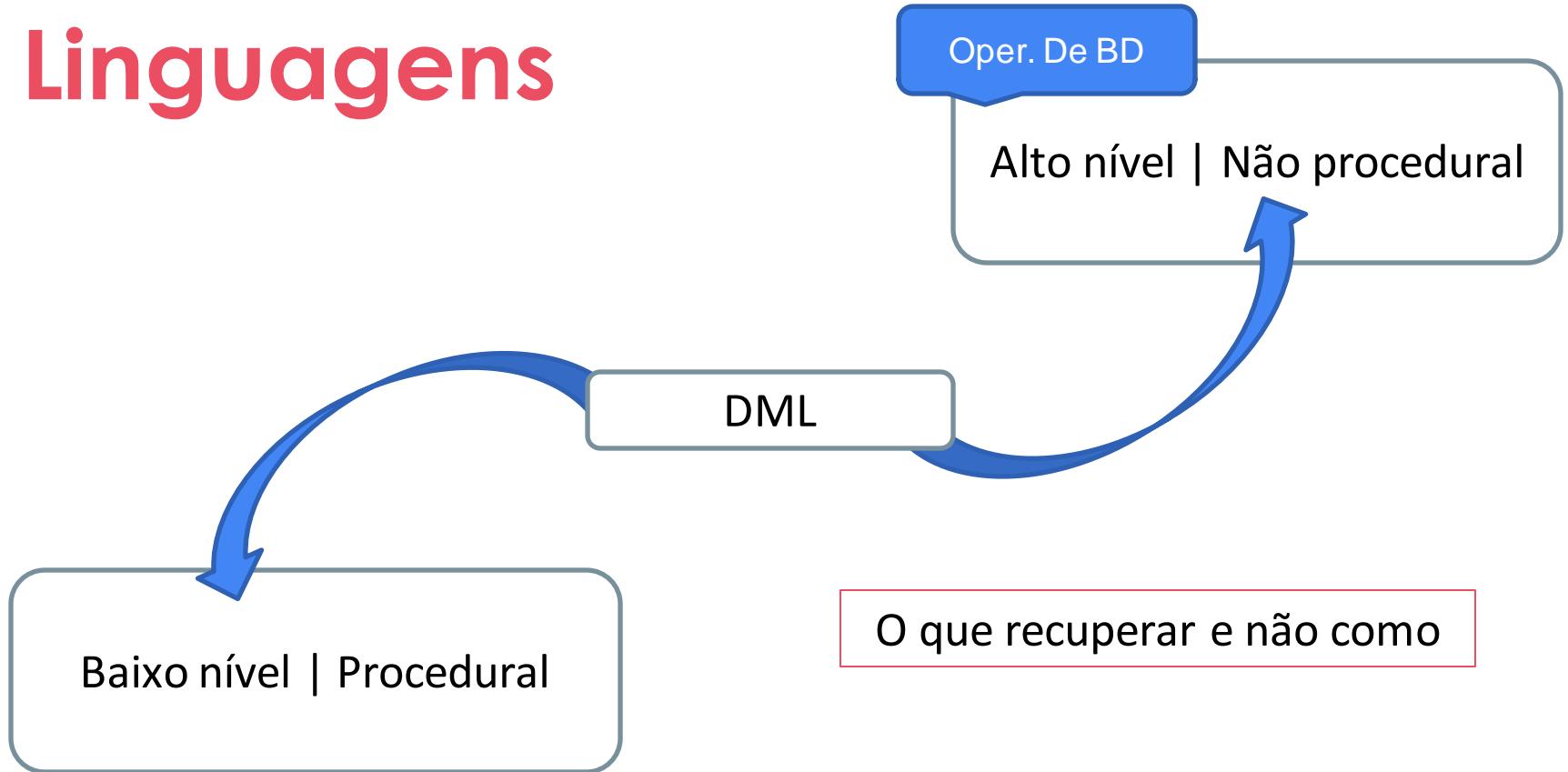


Separação explícita

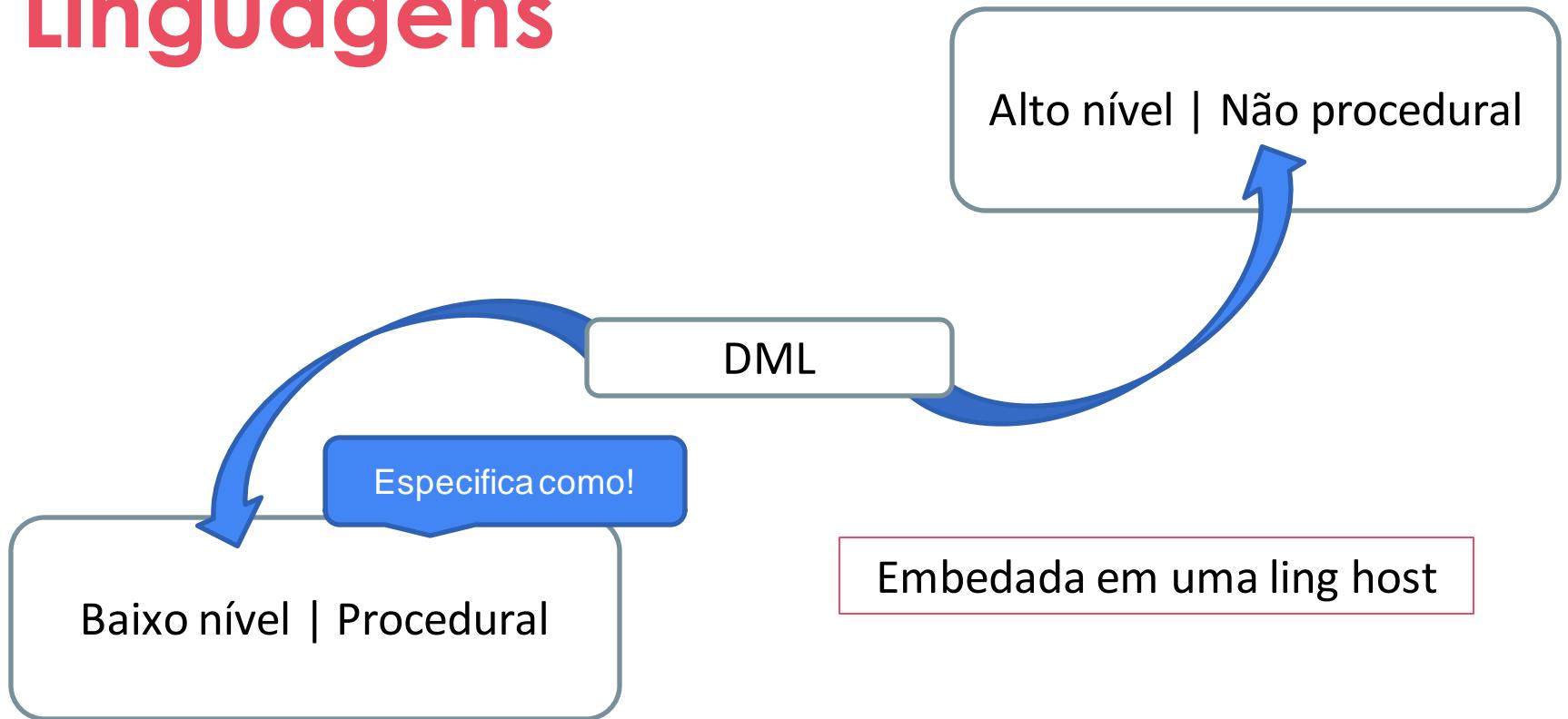
# Linguagens



# Linguagens



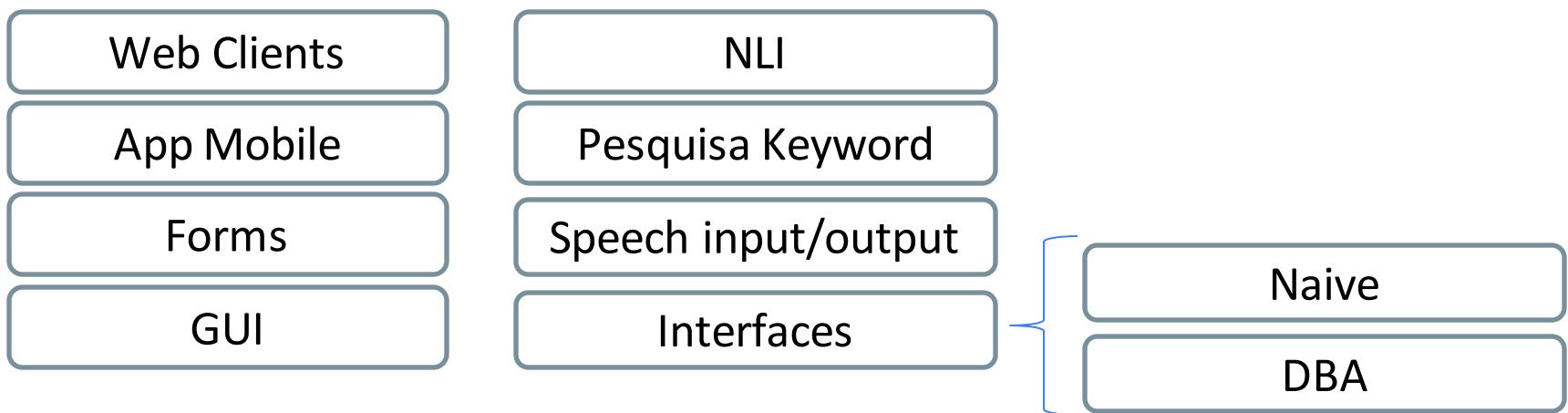
# Linguagens



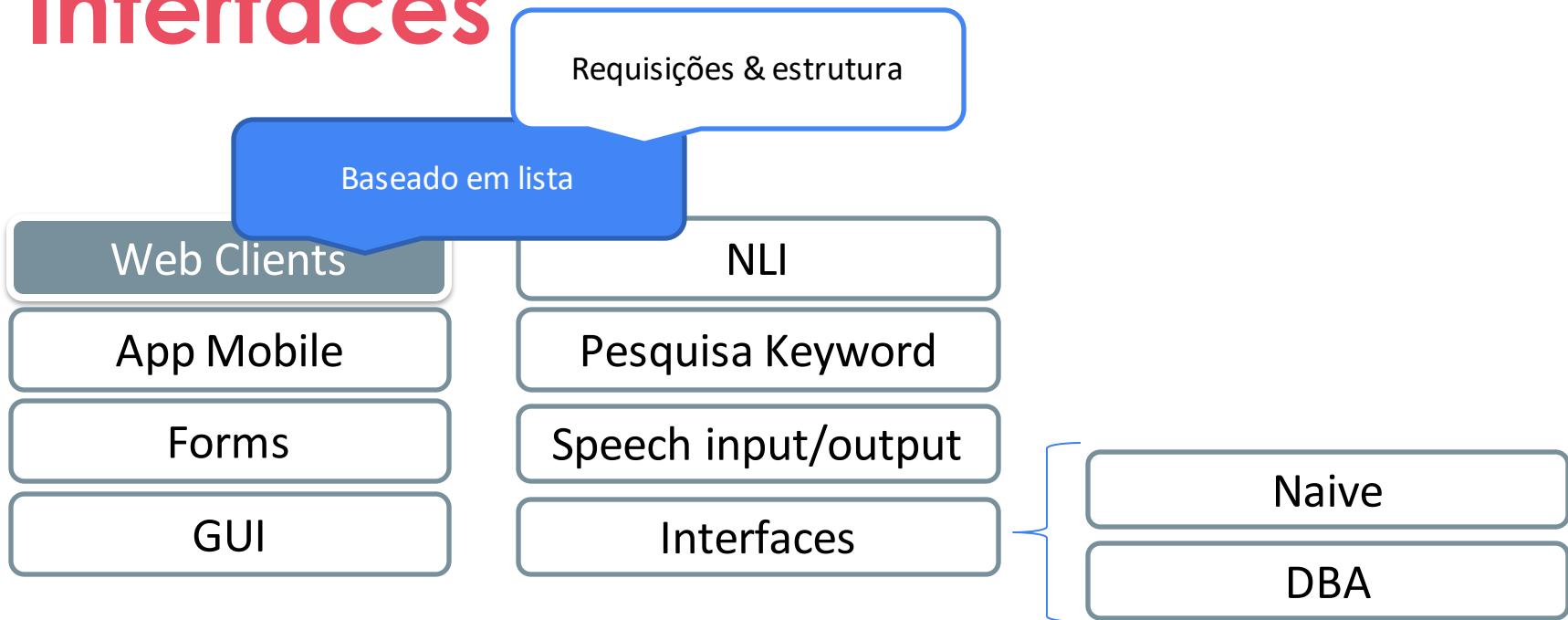
# Interfaces



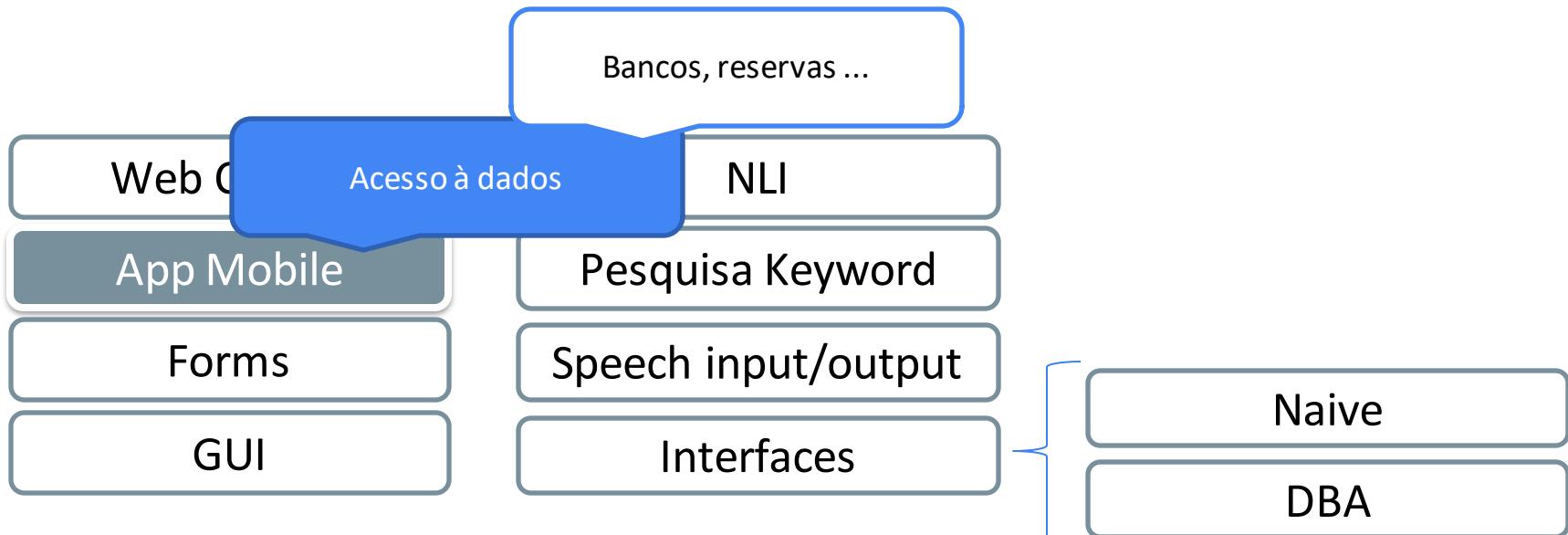
# Interfaces



# Interfaces

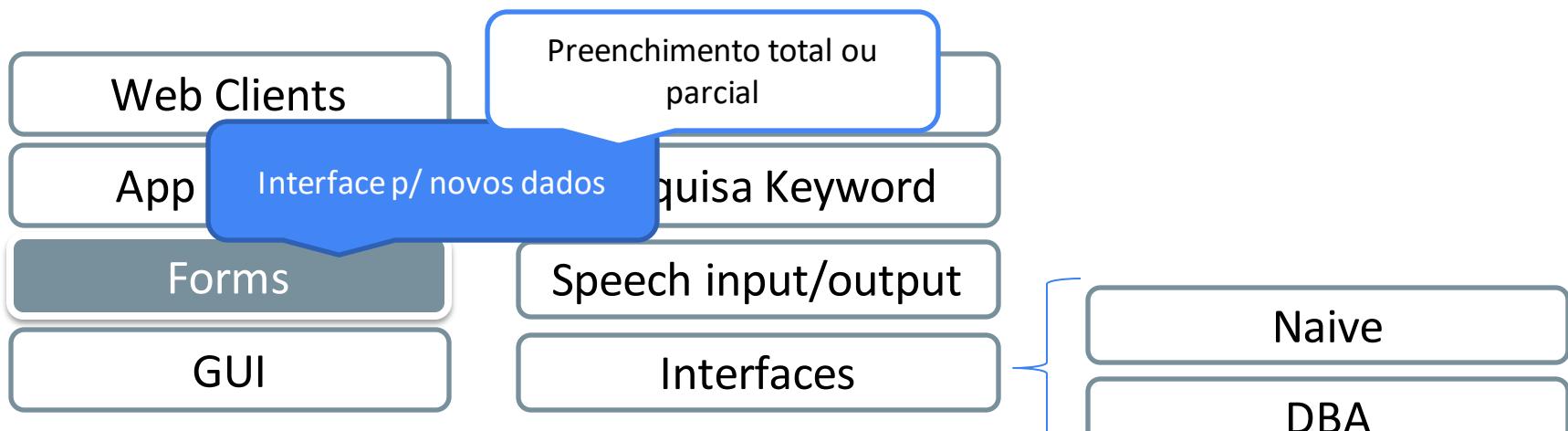


# Interfaces



Menu limitado pelo app

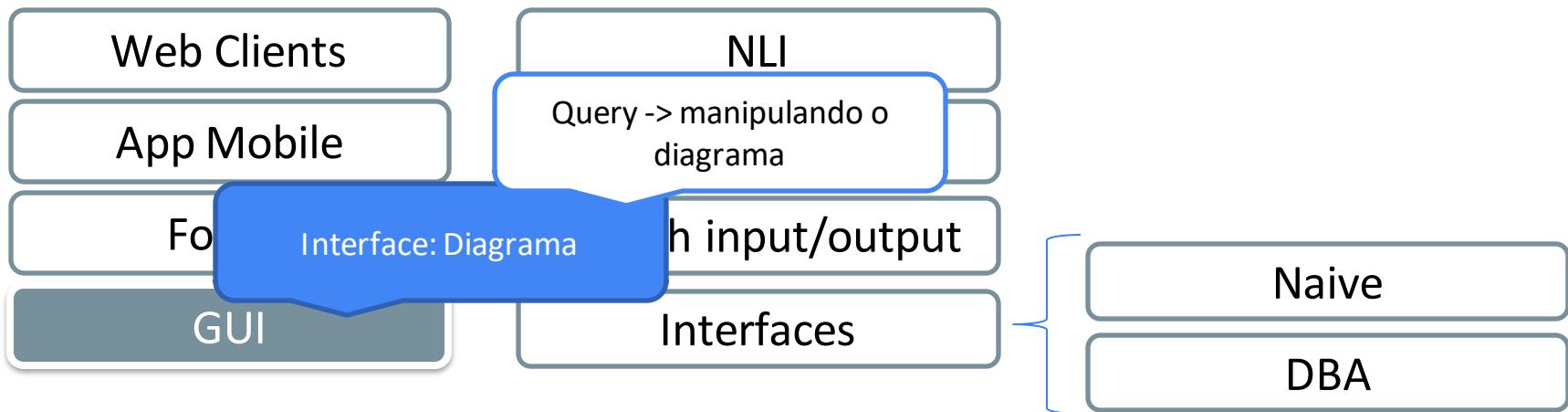
# Interfaces



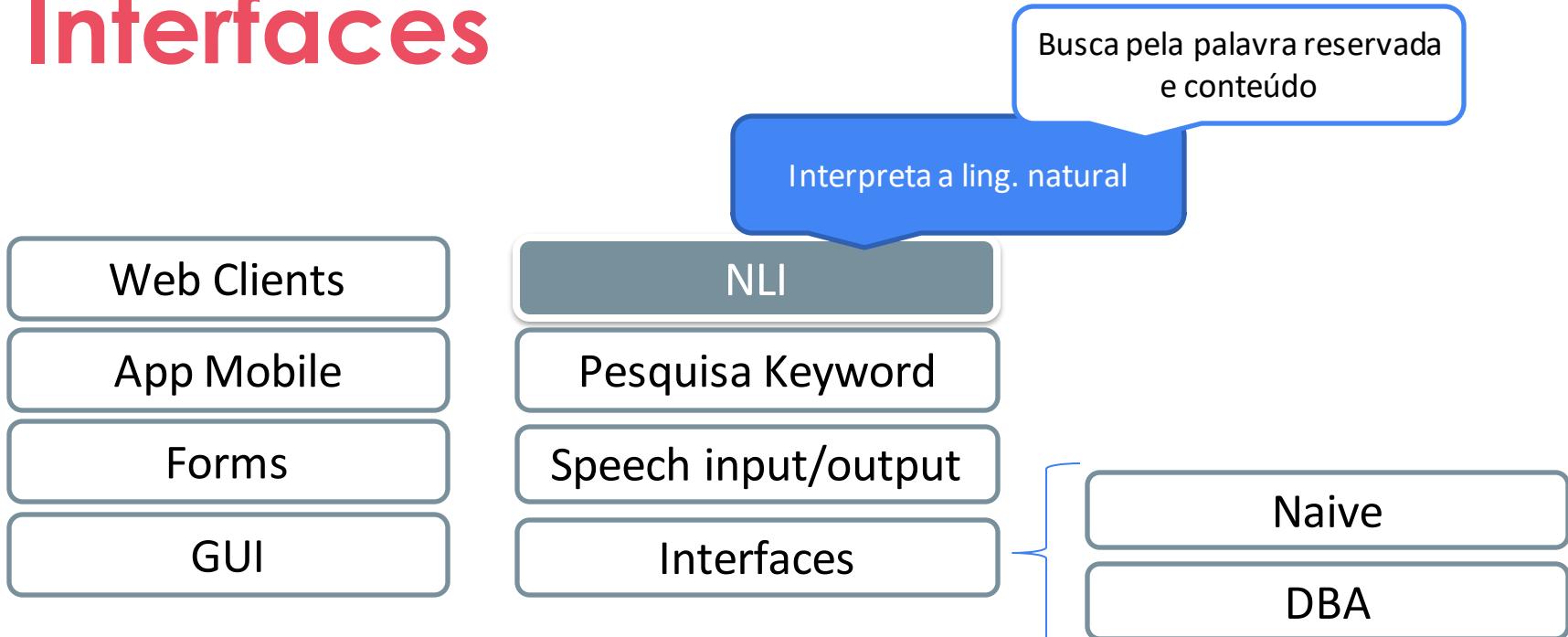
Voltados para Naive com transações canned

SQL\*Forms

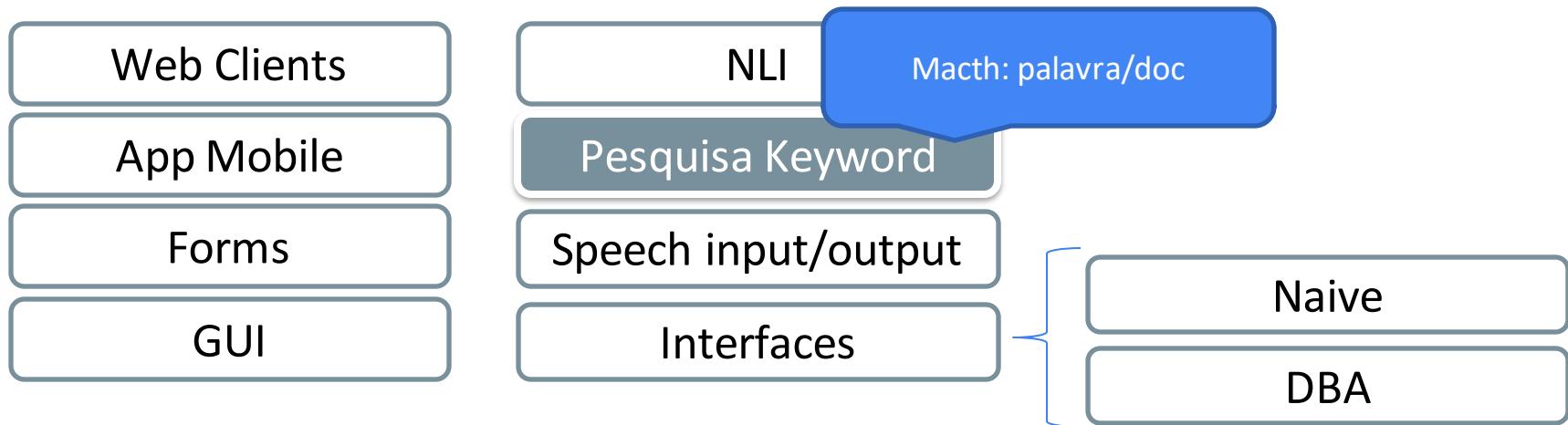
# Interfaces



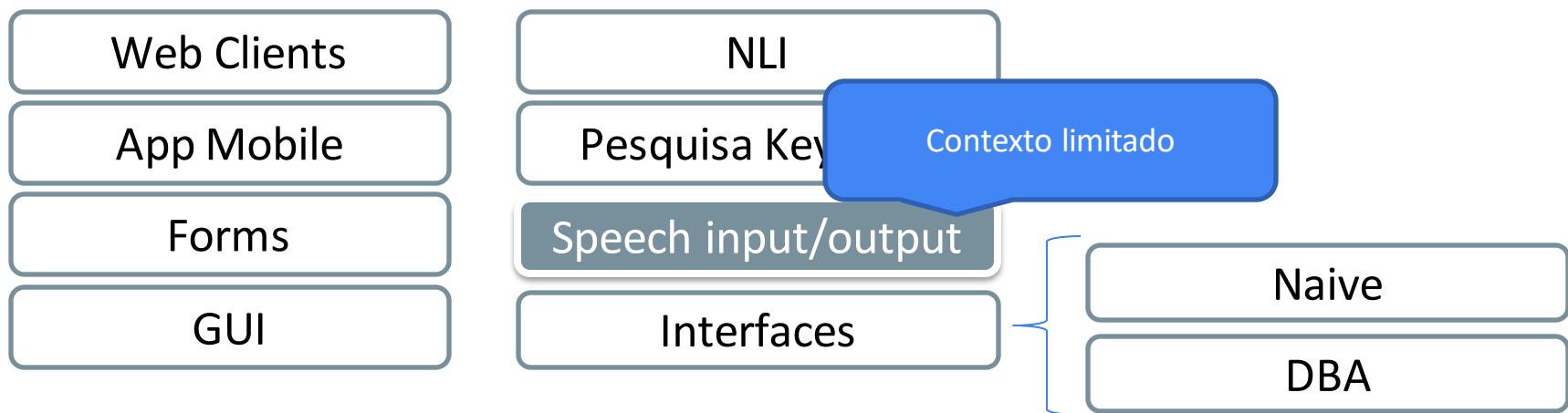
# Interfaces



# Interfaces

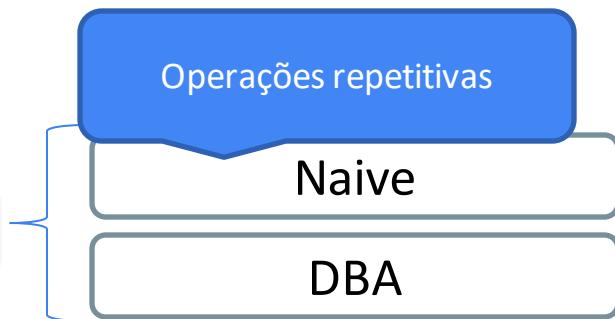
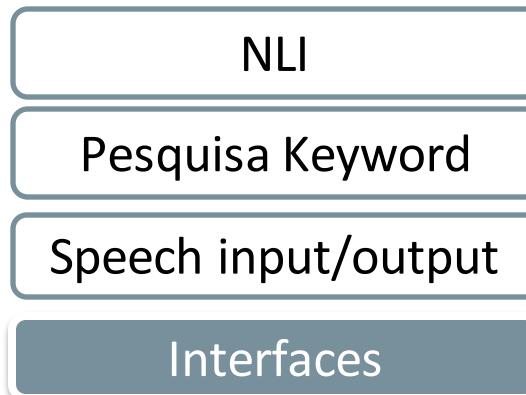


# Interfaces



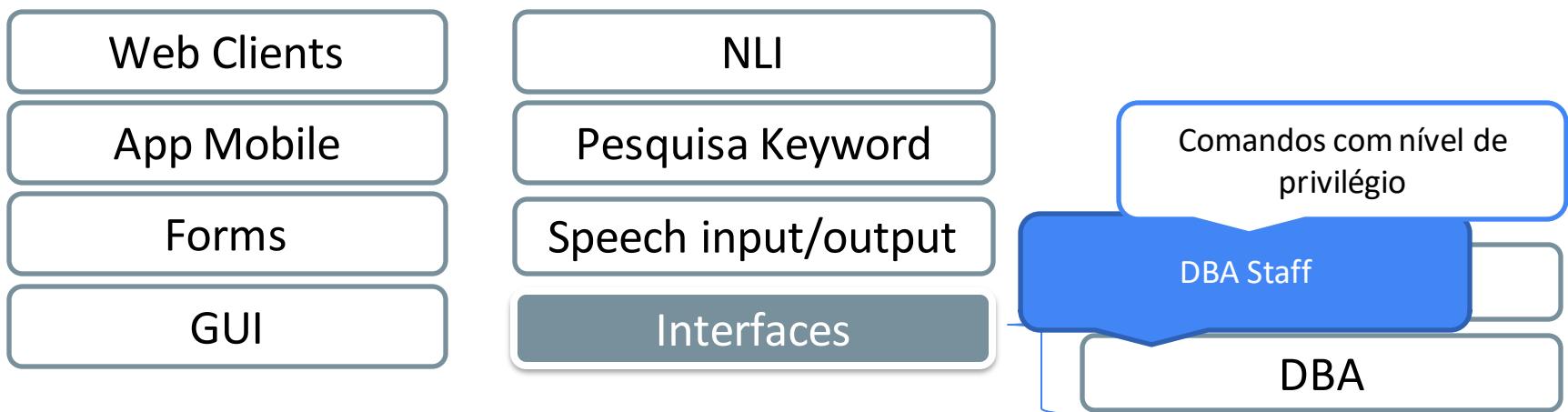
Speech como input e resposta

# Interfaces



Transações de rotina e repetitivas - saldo do banco

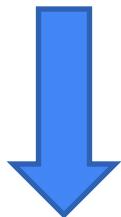
# Interfaces



# Ambiente



# Componentes



Software



Modularizado

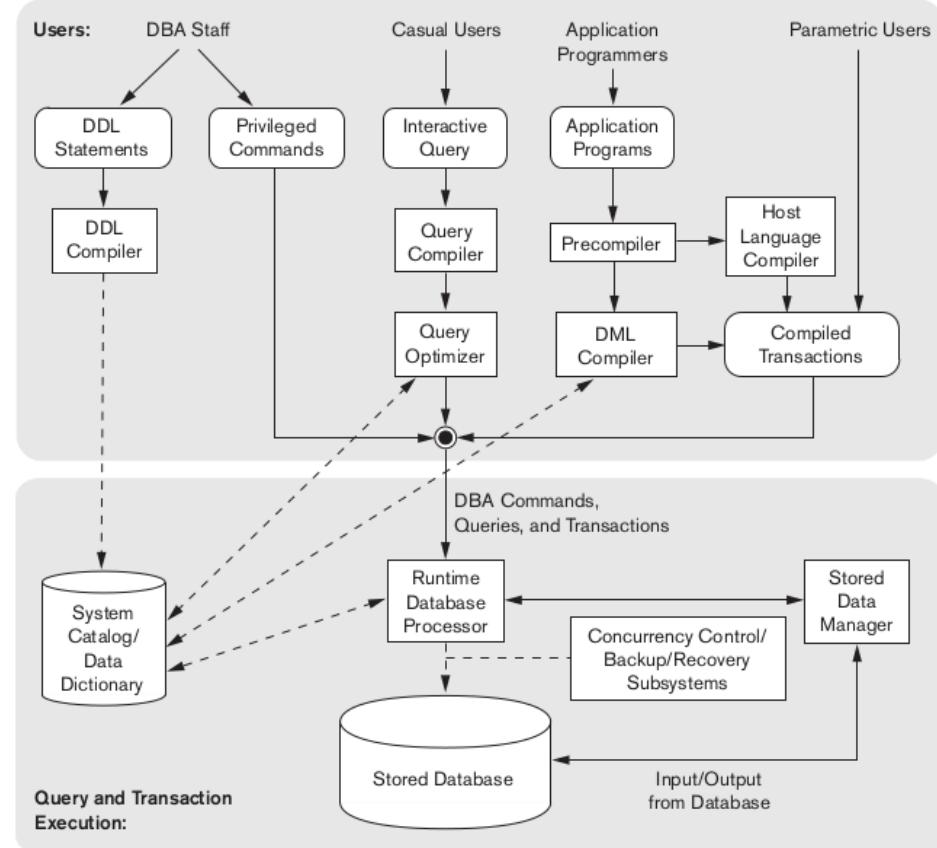


Figure 2.3

Component modules of a DBMS and their interactions.

# Componentes

Ambiente de BD

Módulos internos

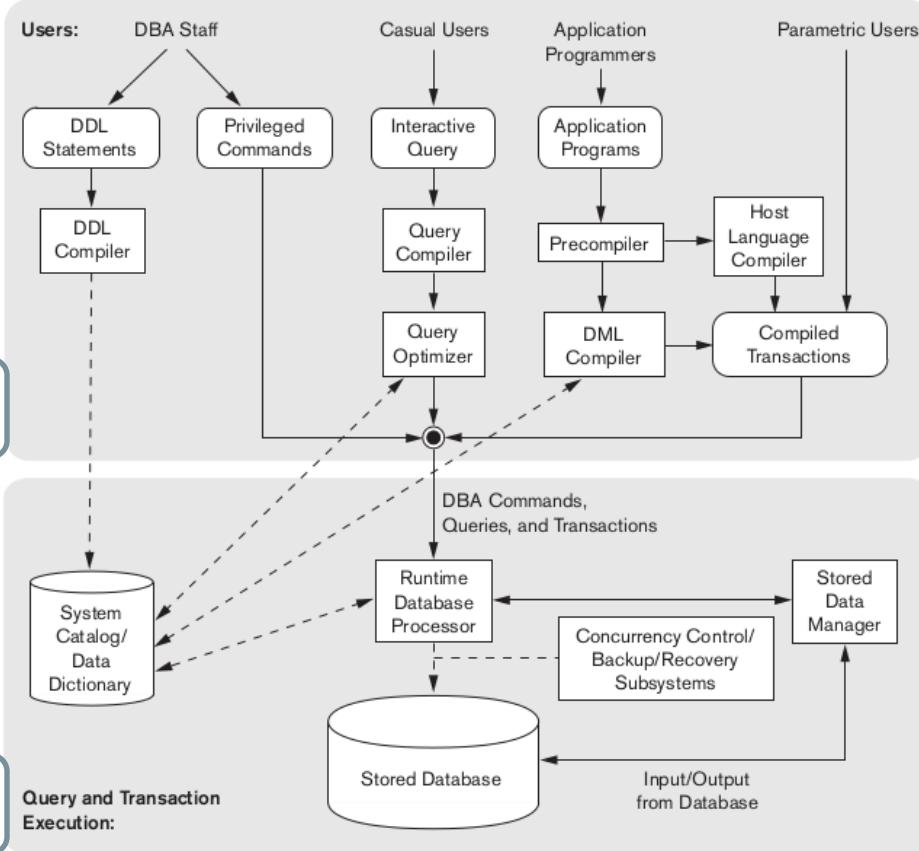


Figure 2.3

Component modules of a DBMS and their interactions.

# Componentes

Esquema

Info de módulos

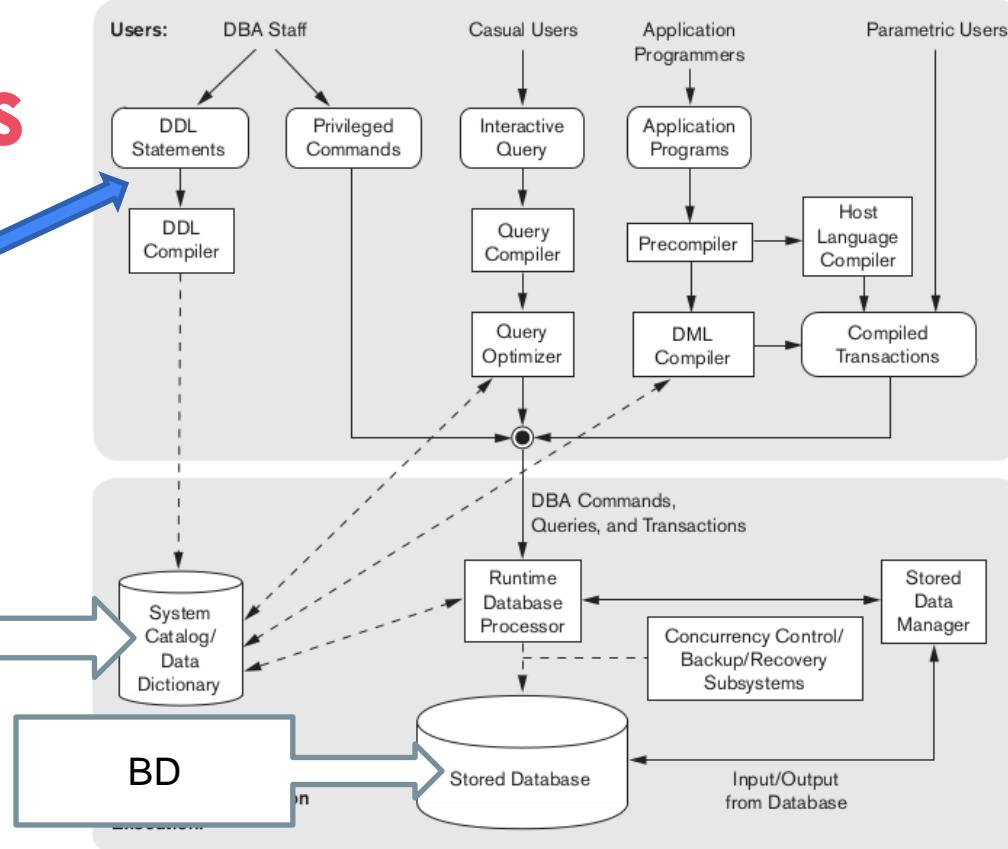


Figure 2.3

Component modules of a DBMS and their interactions.

# Componentes

Acesso ocasional

Ex: Reordenação de operações

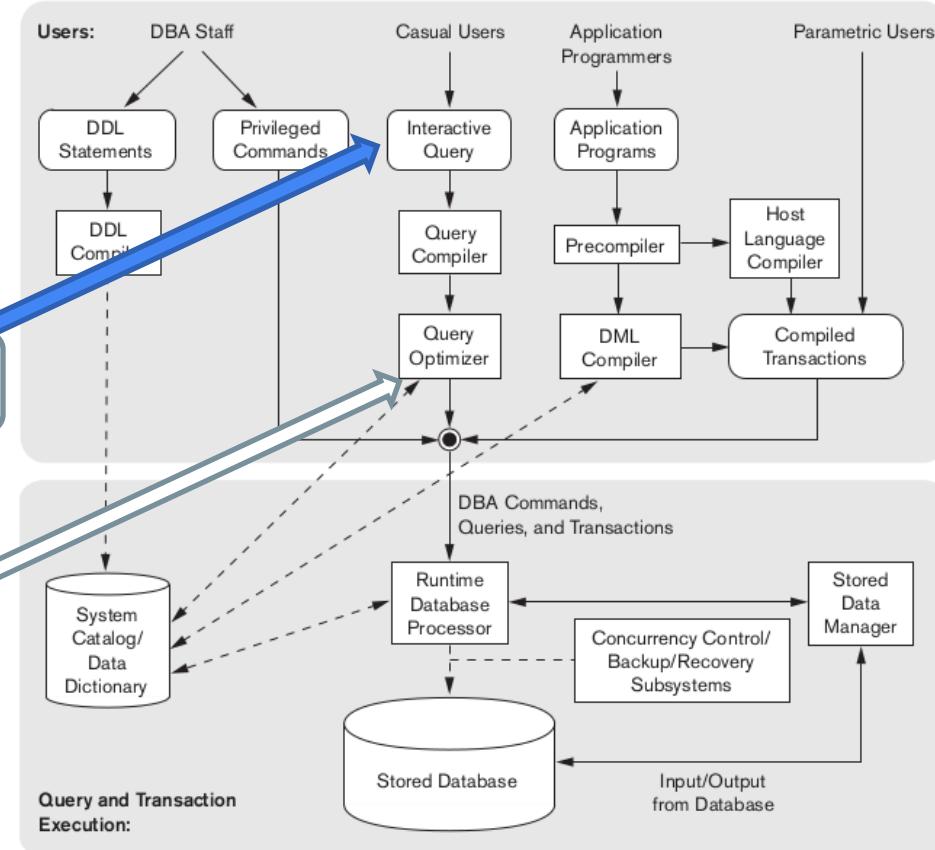


Figure 2.3

Component modules of a DBMS and their interactions.

# Componentes

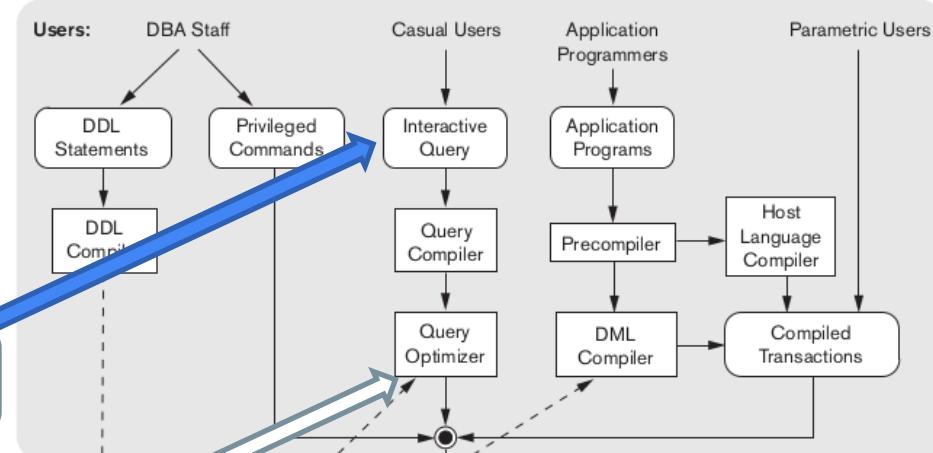
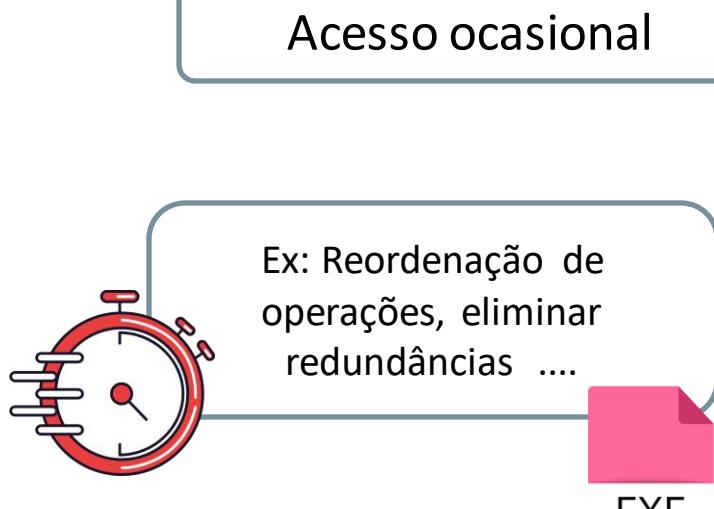


Figure 2.3  
Component modules of a DBMS and their interactions.

# Componentes



Linguagens de prog.

Extrai DML

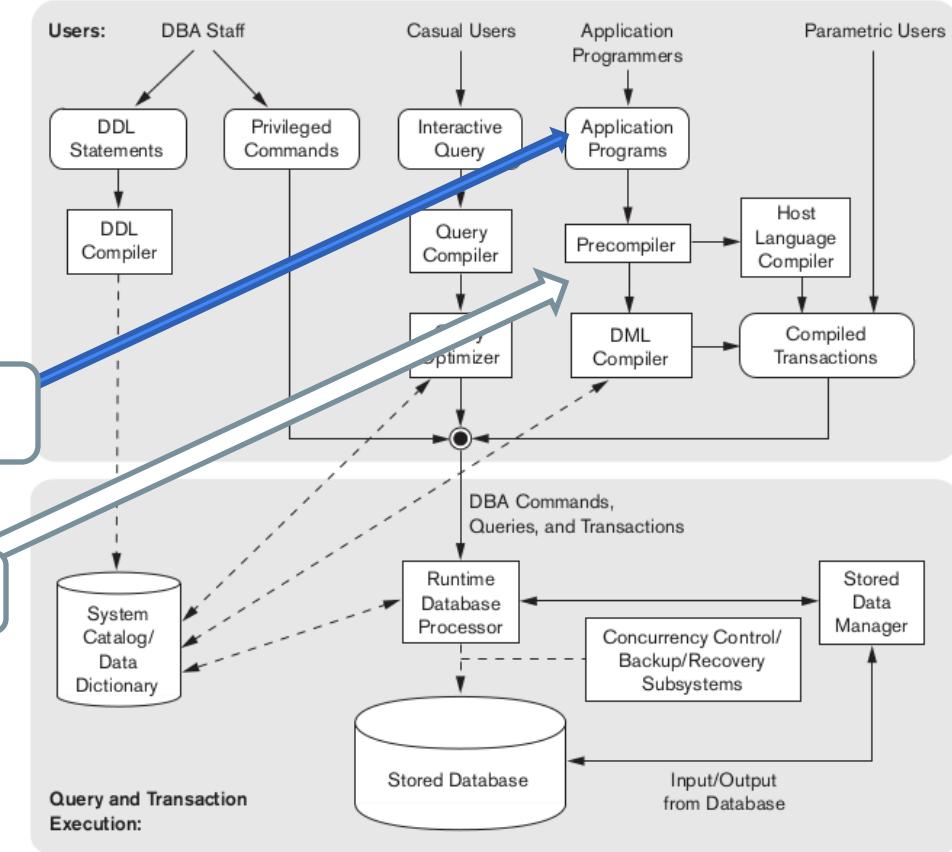


Figure 2.3

Component modules of a DBMS and their interactions.

# Componentes

Canned Transaction

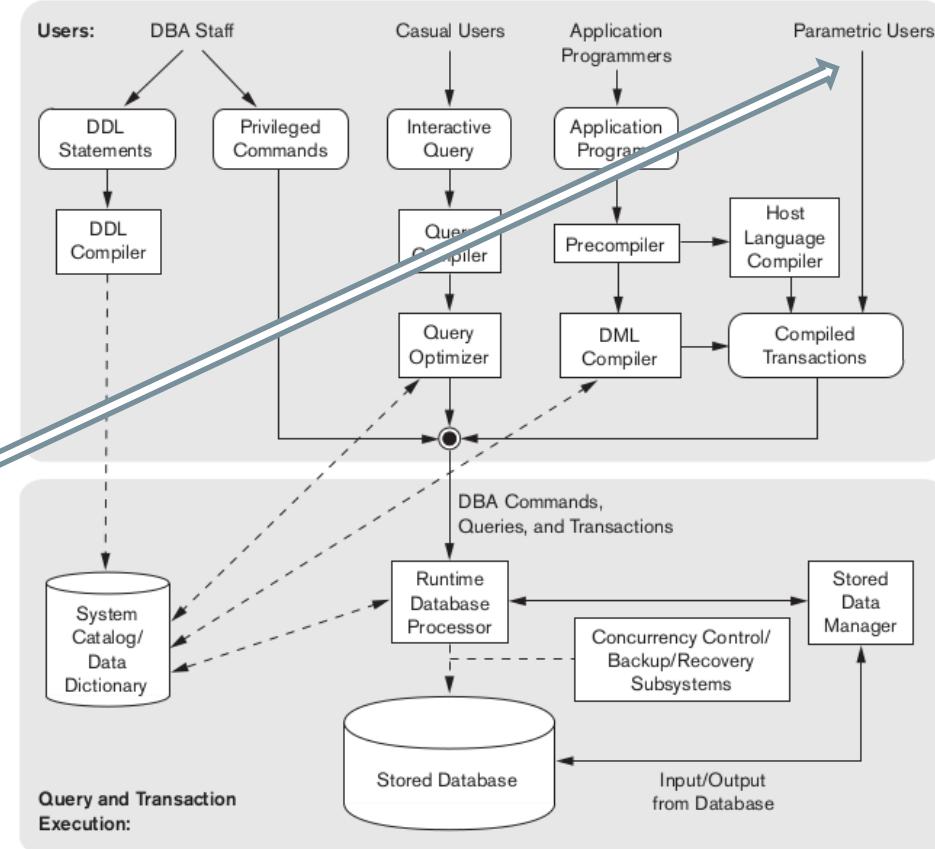


Figure 2.3

Component modules of a DBMS and their interactions.

# Componentes

Privileged commands,  
Query plans,  
Canned transactions ...

Infos de hd/ram

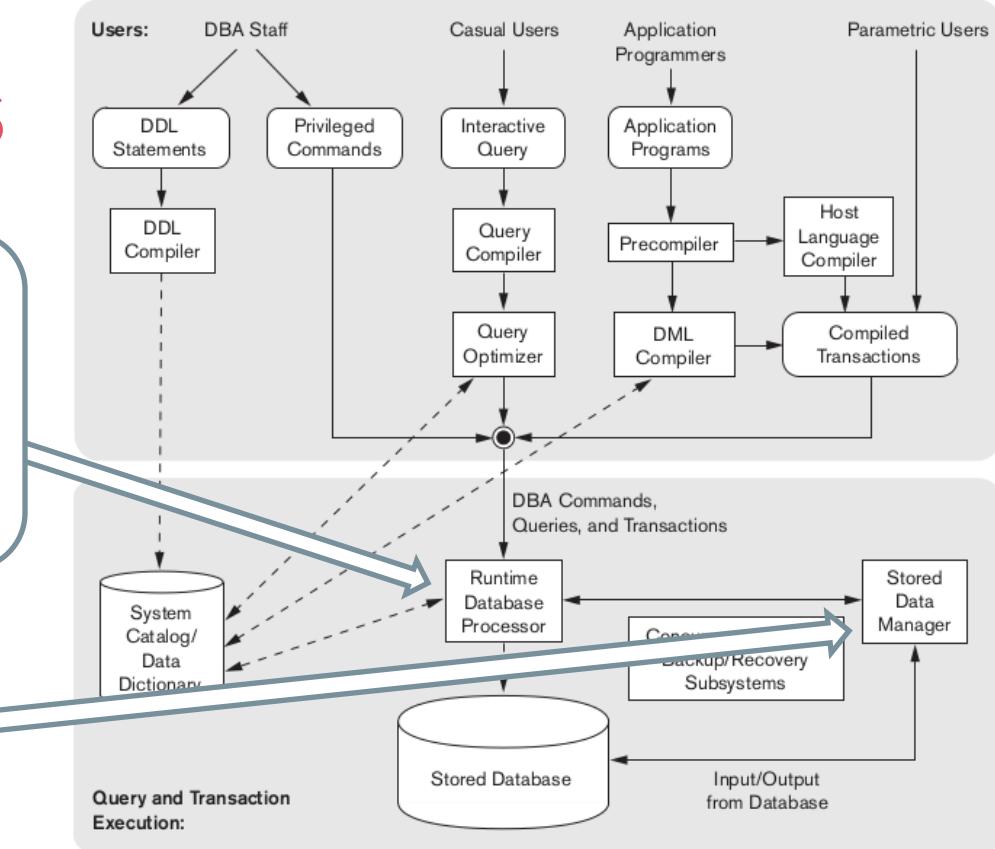


Figure 2.3

Component modules of a DBMS and their interactions.

# Componentes

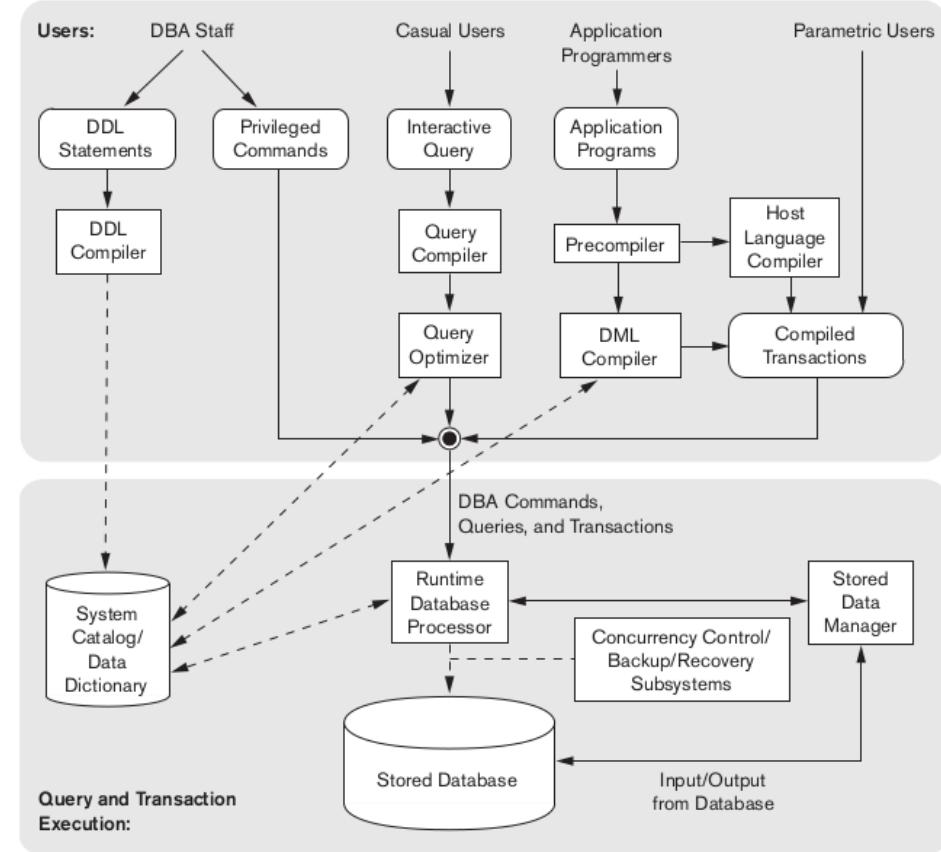
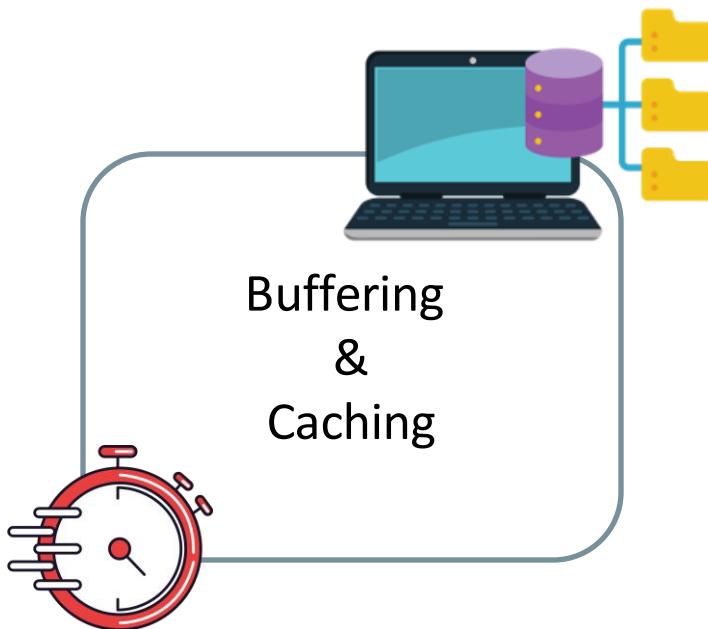
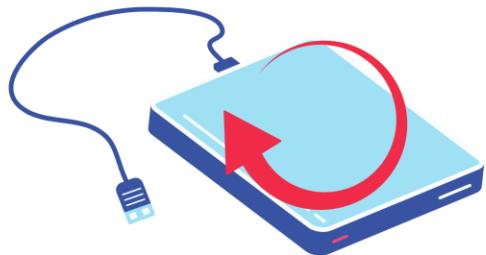


Figure 2.3

Component modules of a DBMS and their interactions.

# Utilities – Gerenciamento



Monitoramento

Reorganização do storage

Backup

Loading

Reformatar os dados



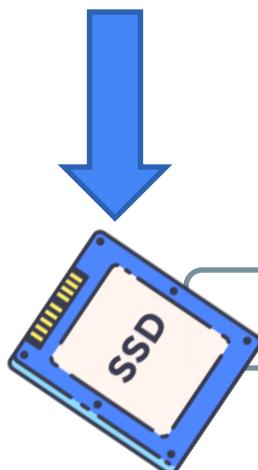
# Utilities – Gerenciamento



Monitoramento

Reorganização do storage

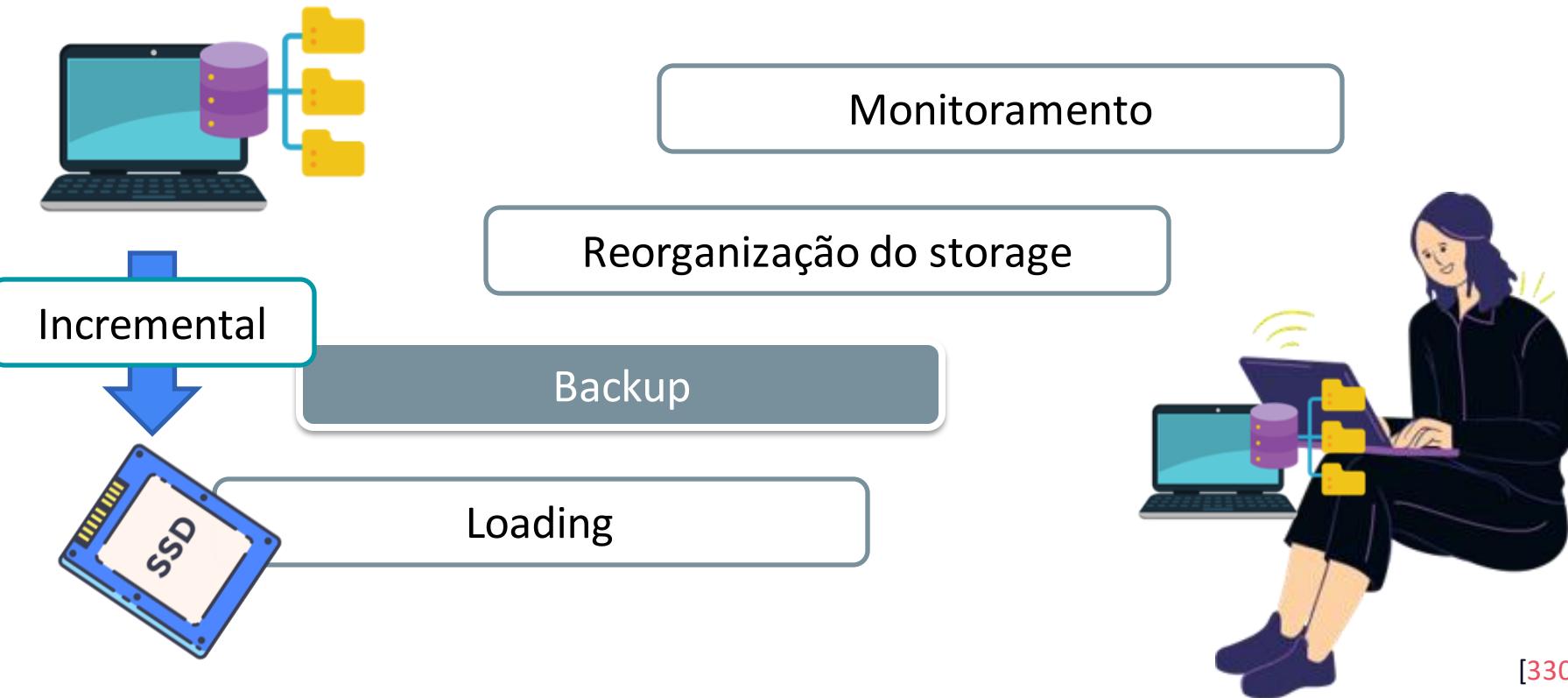
Backup



Loading



# Utilities – Gerenciamento



# Utilities – Gerenciamento



Monitoramento

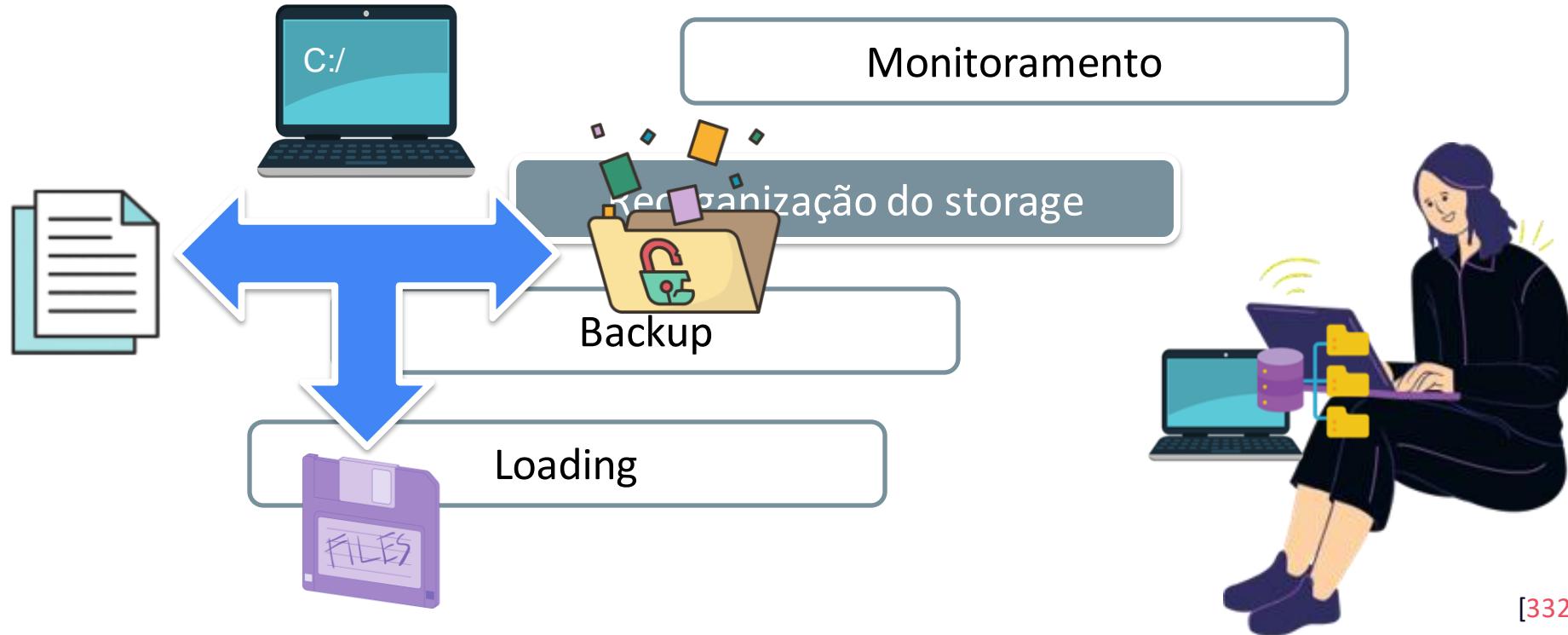
Reorganização do storage

Backup

Loading



# Utilities – Gerenciamento



# Utilities – Gerenciamento



Monitoramento

Reorganização do storage

Backup

Loading

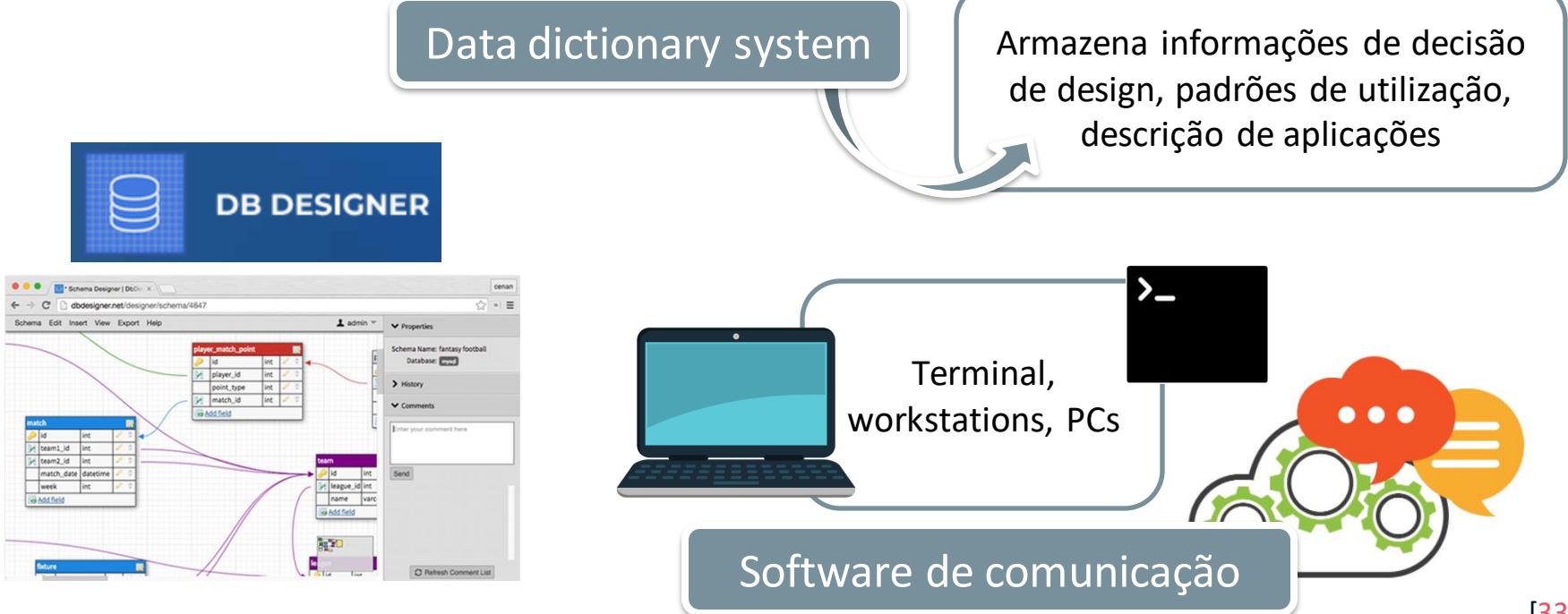
Estatísticas do BD



Decisões



# Ferramentas e aplicações

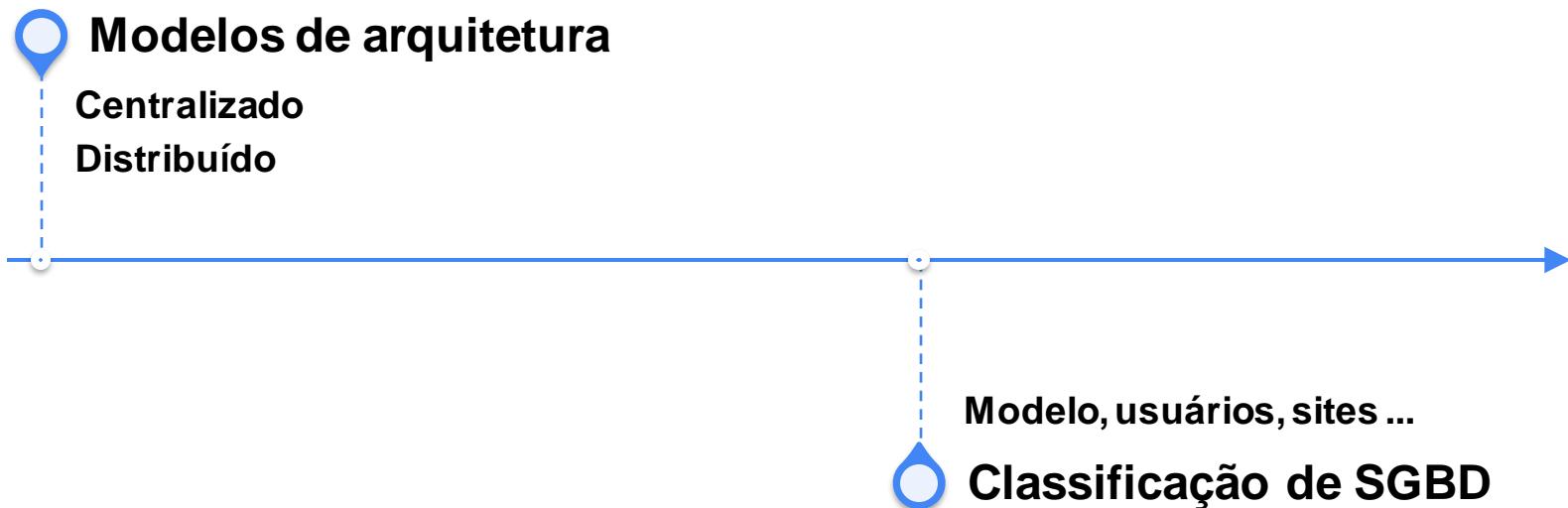


## Etapa 10

# Arquitetura: Modelo Cliente-servidor e Classificação de SGBDs

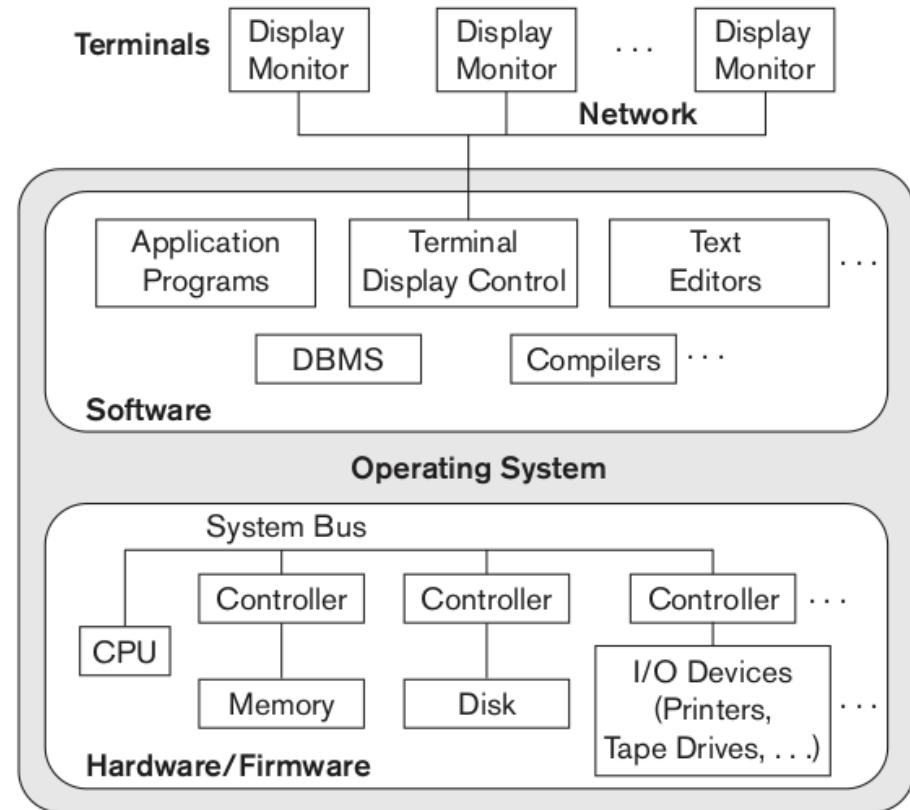
// Introdução à Banco de dados

# Conversa

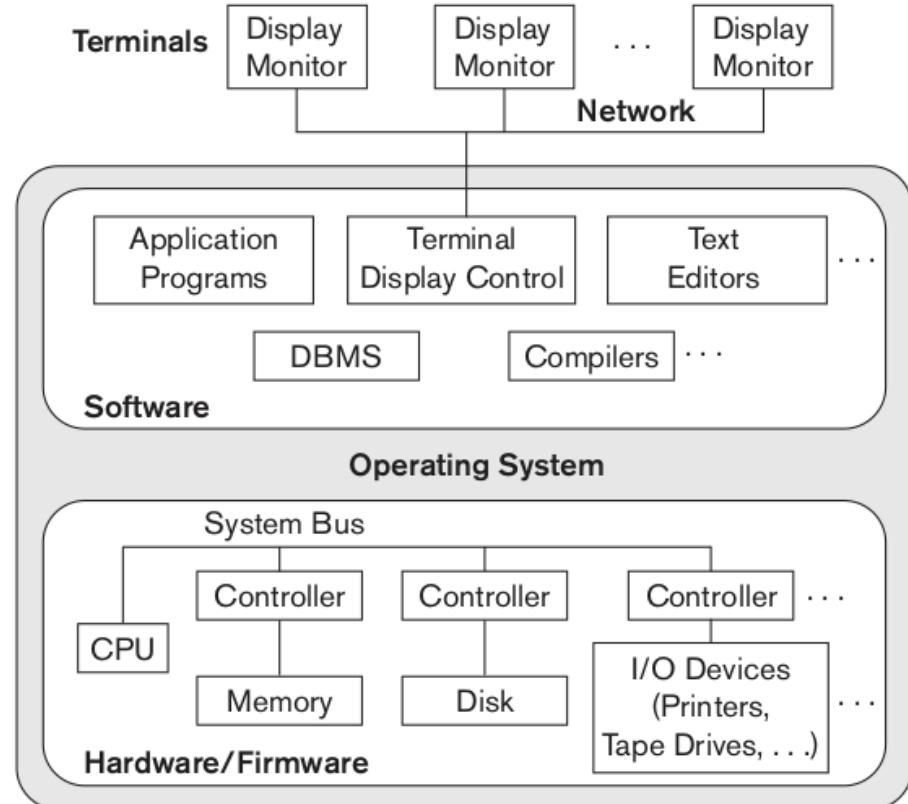
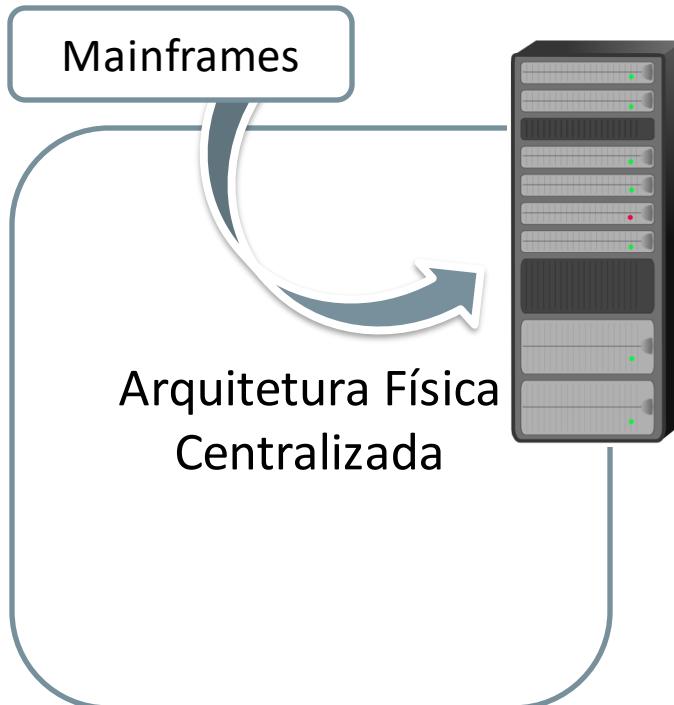


# Arquitetura

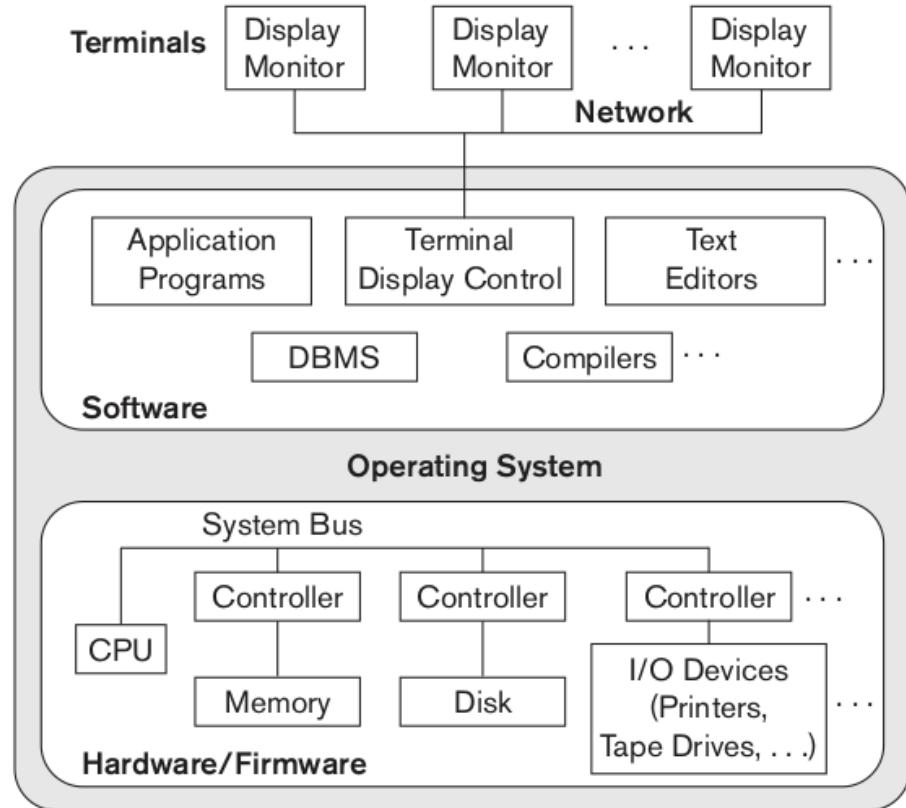
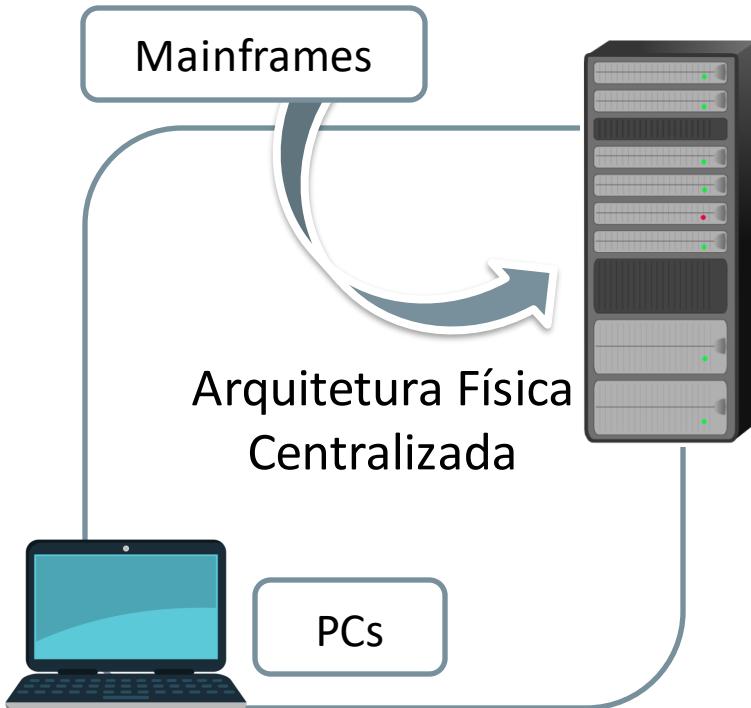
Arquitetura Física  
Centralizada



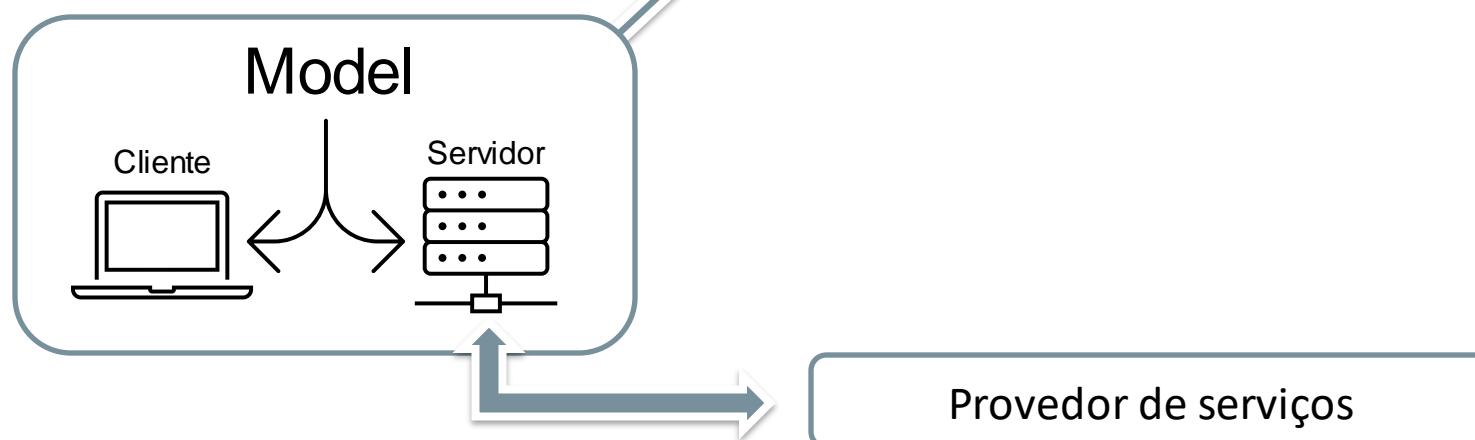
# Arquitetura



# Arquitetura



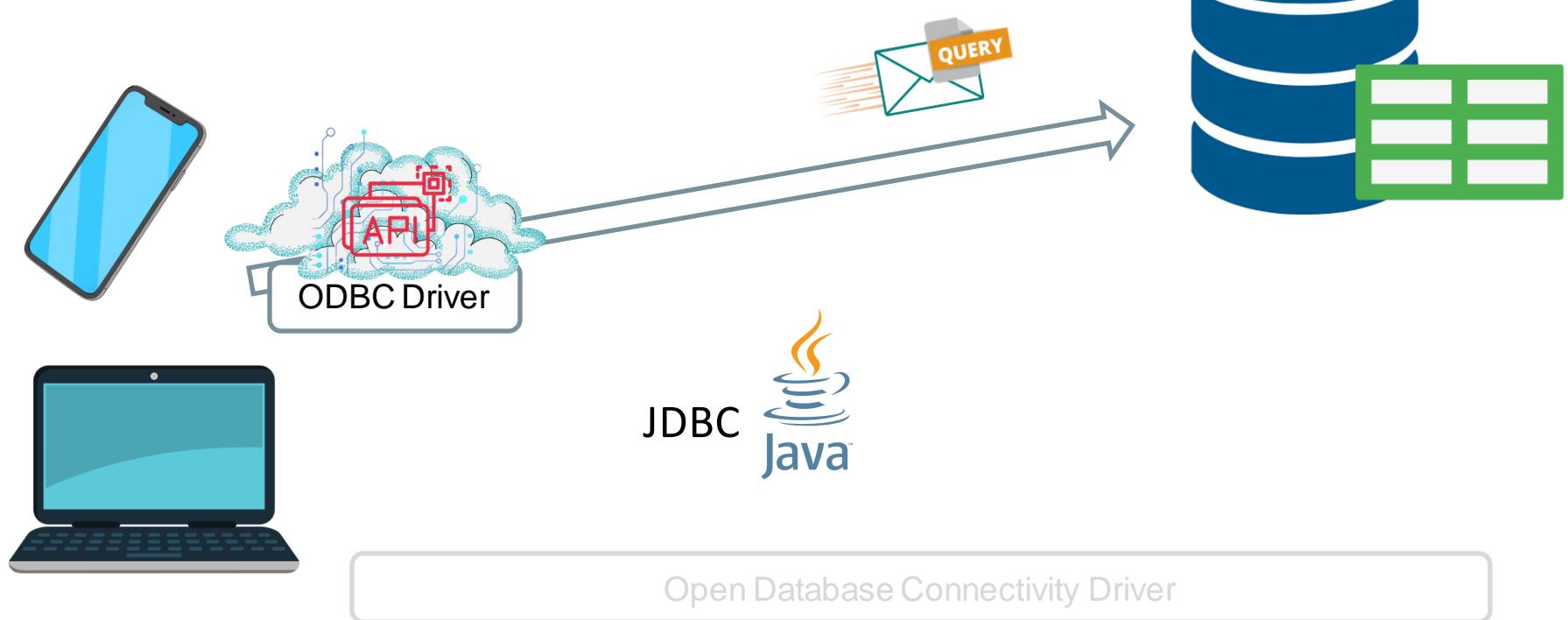
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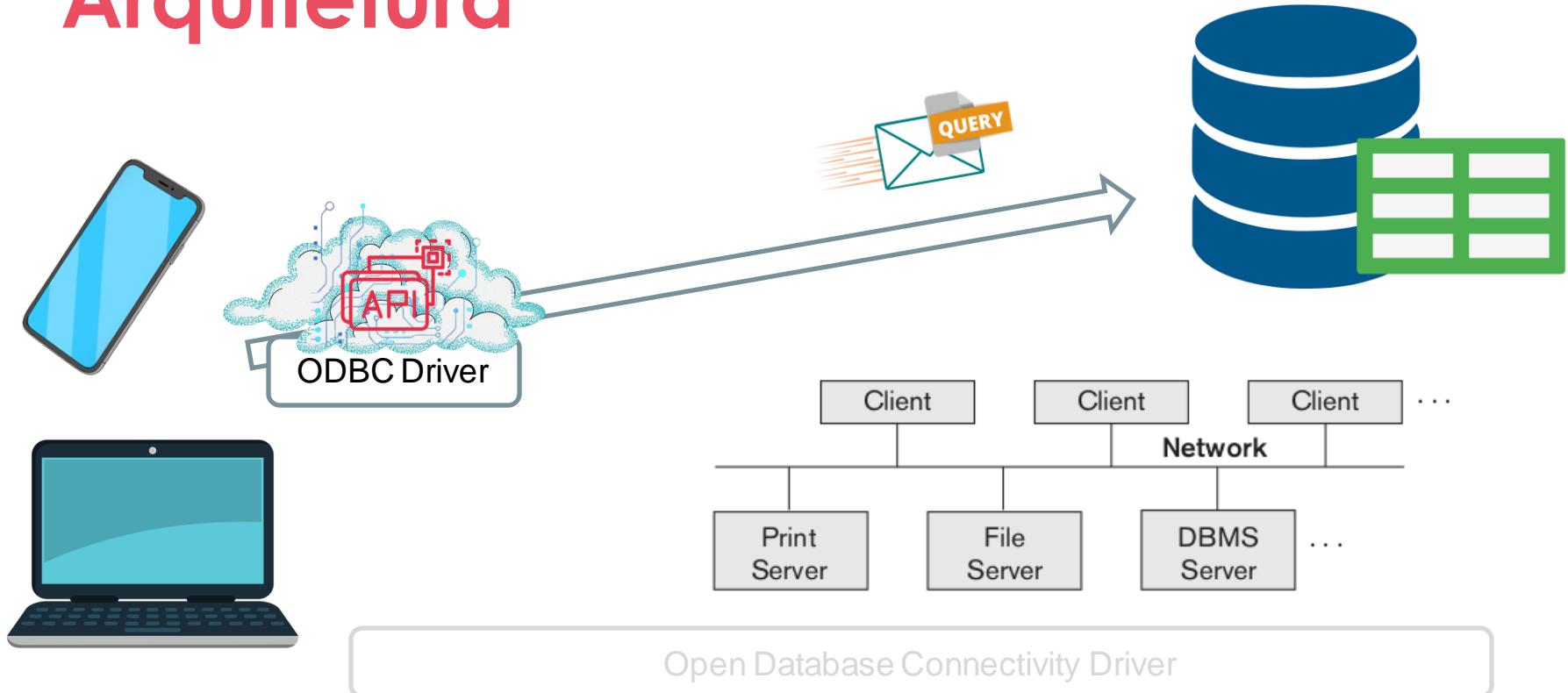
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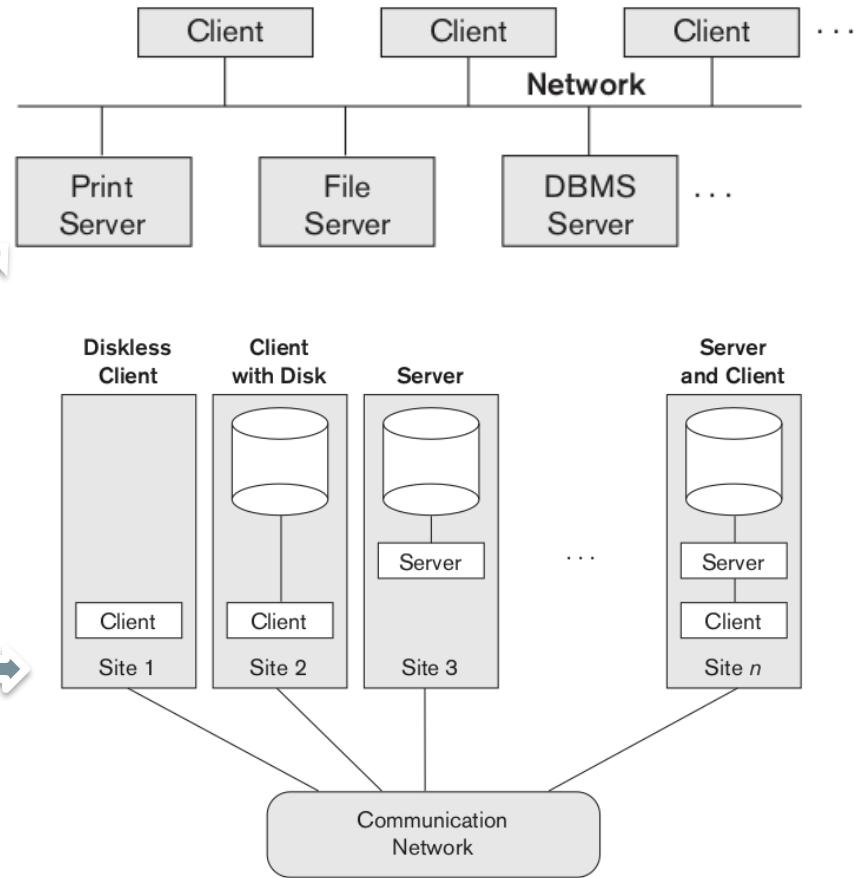
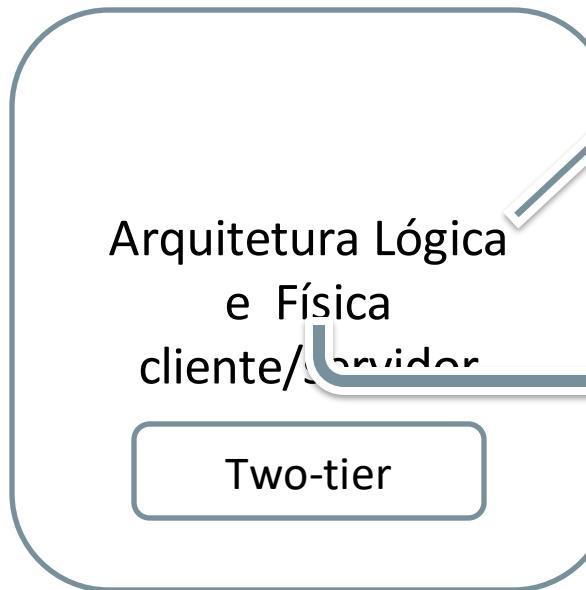
# Arquitetura



# Arquitetura



# Arquitetura

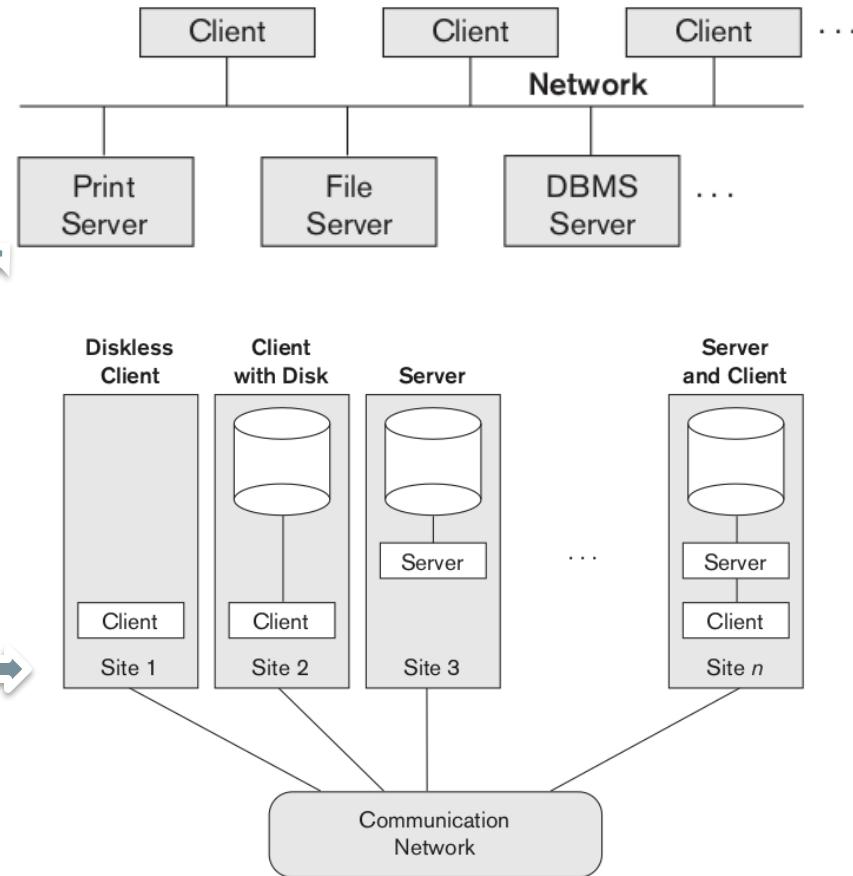


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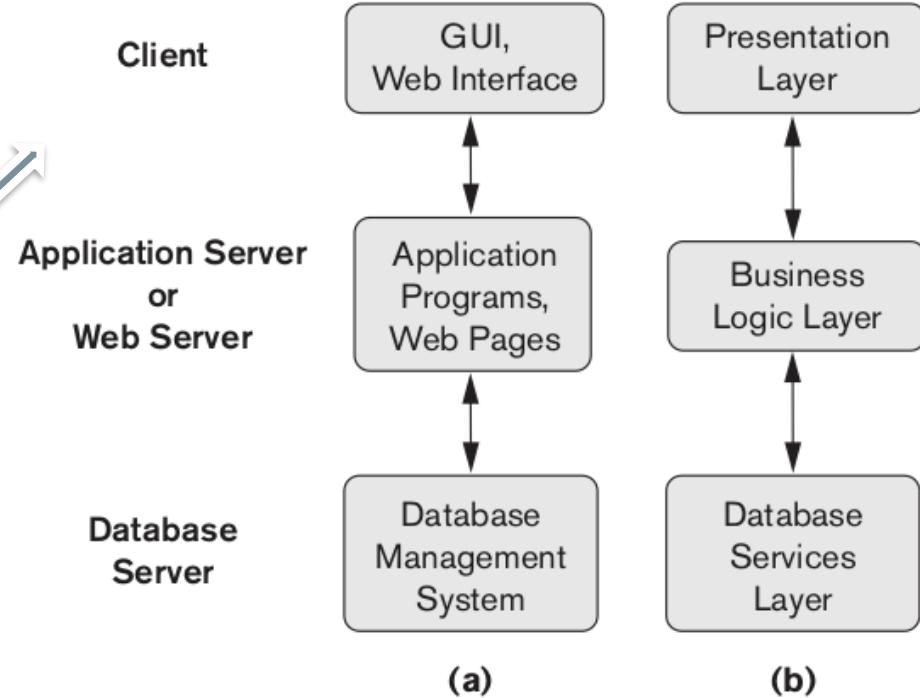
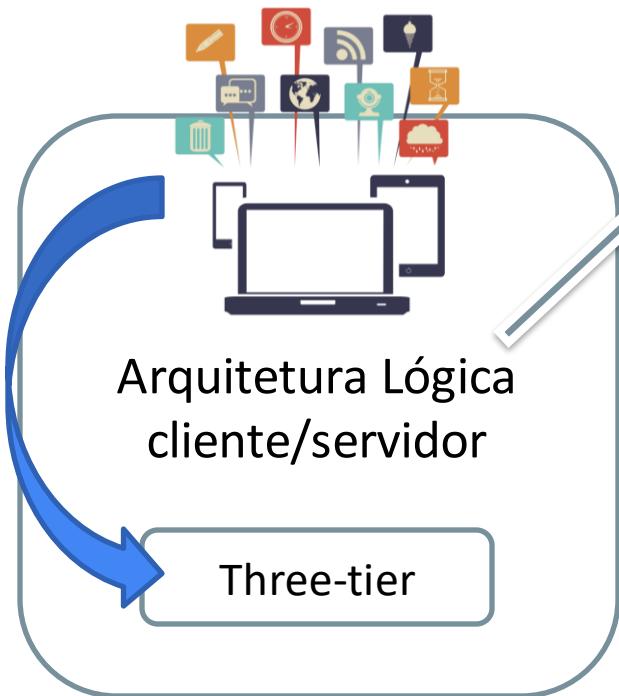
Simplicidade & Compatibilidade

Arquitetura Lógica  
e Física  
cliente/Servidor

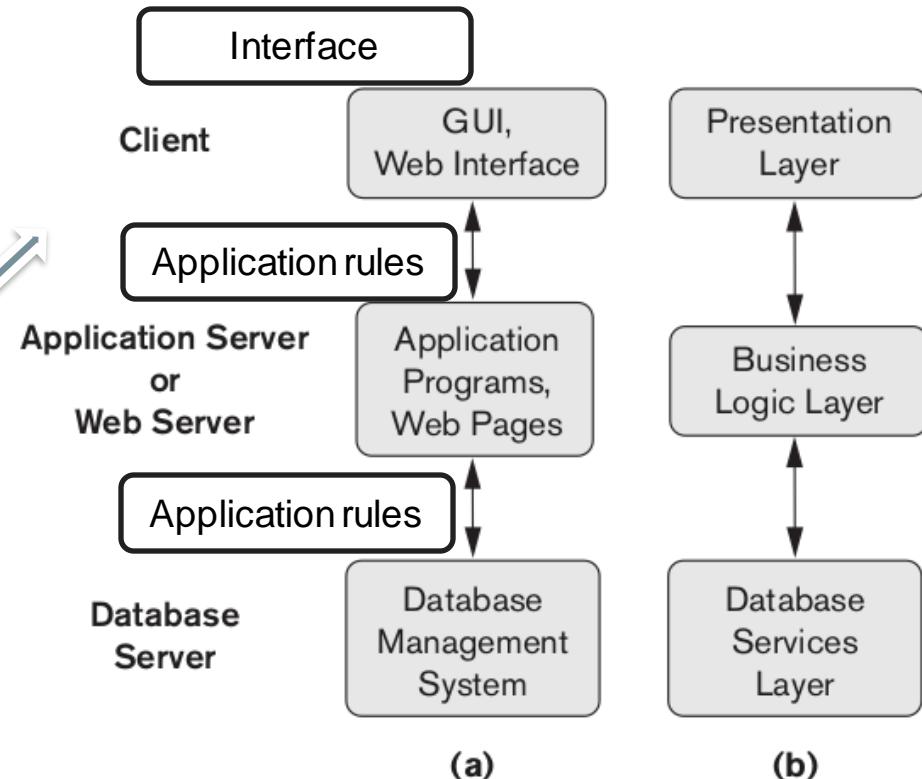
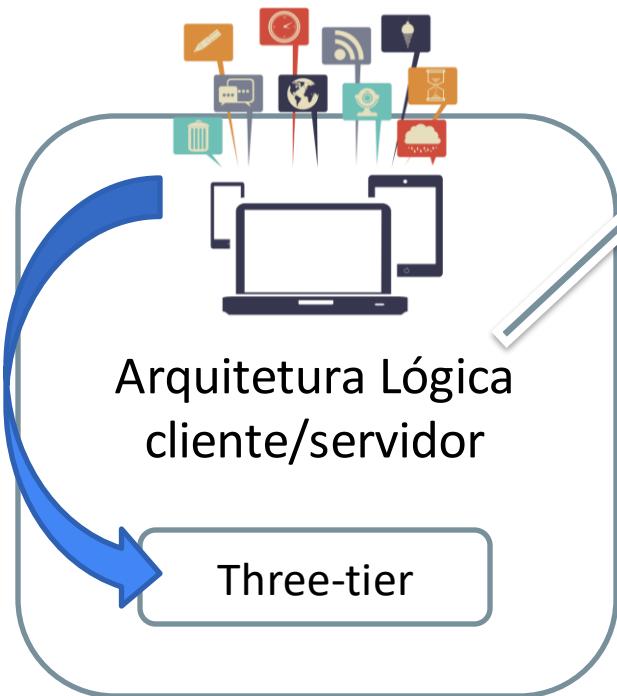
Two-tier



# Arquitetura



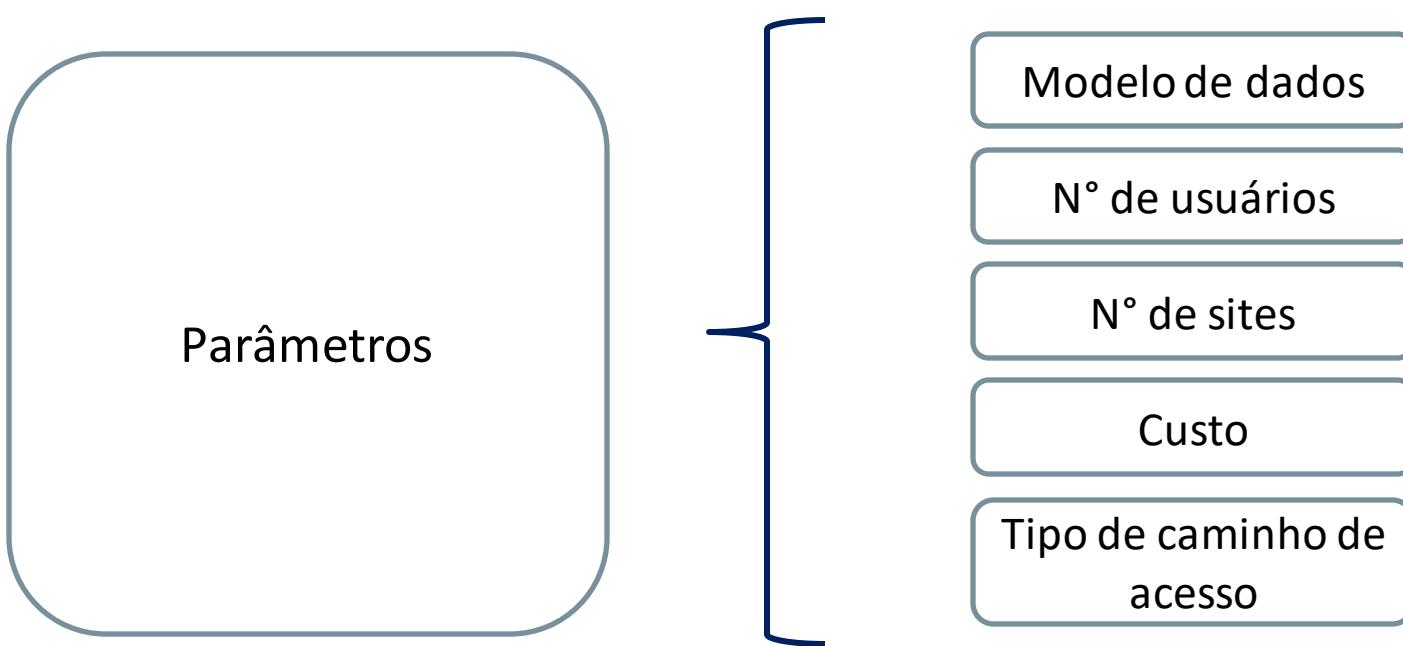
# Arquitetura



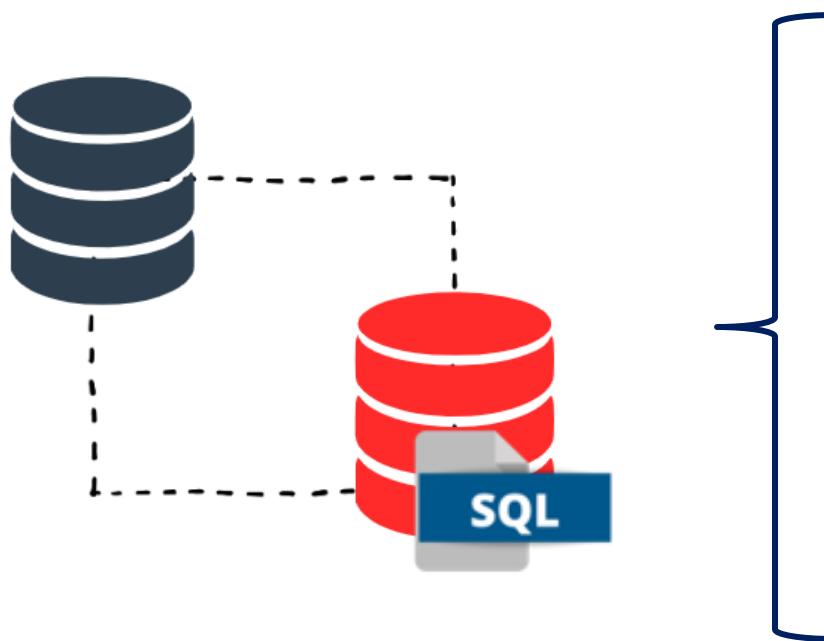
# Classificação de SGBDs



# Classificação



# Classificação



Modelo de dados

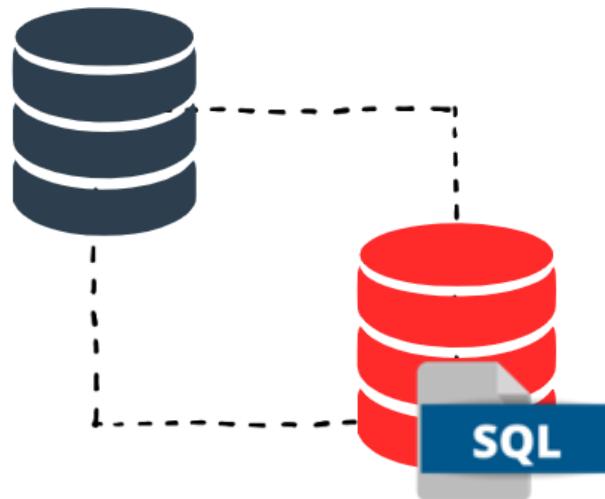
Nº de usuários

Nº de sites

Custo

Tipo de caminho de  
acesso

# Classificação



Modelo de dados

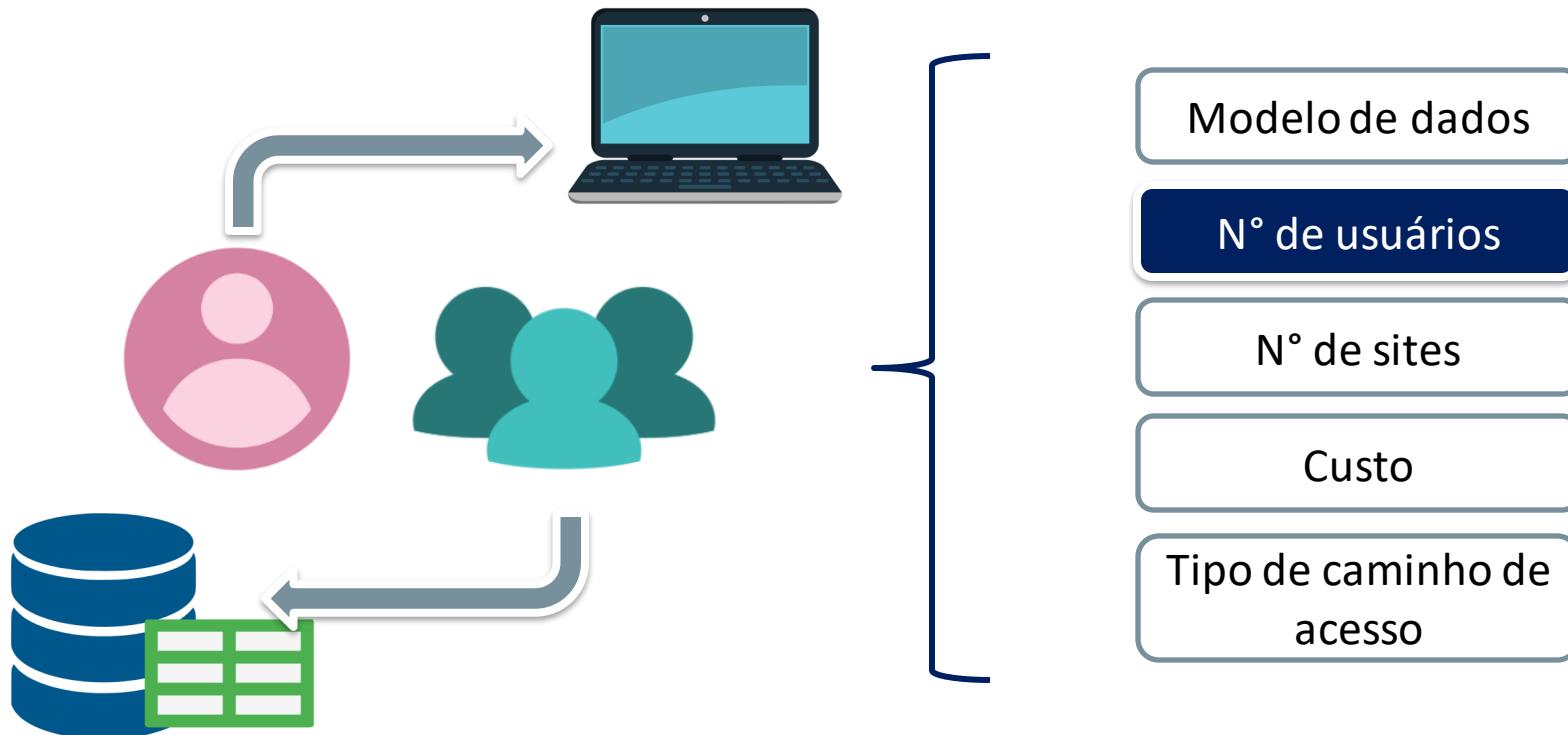
Nº de usuários

Nº de sites

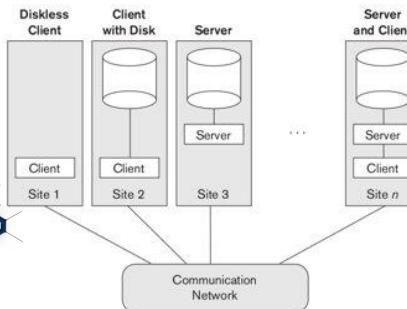
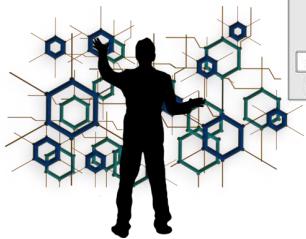
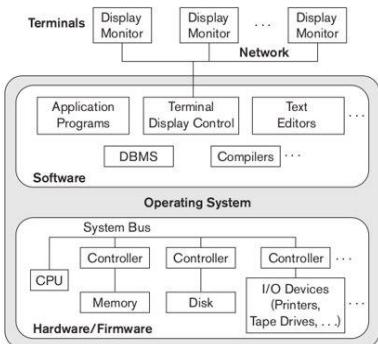
Custo

Tipo de caminho de  
acesso

# Classificação



# Classificação



Modelo de dados

Nº de usuários

Nº de sites

Custo

Tipo de caminho de acesso

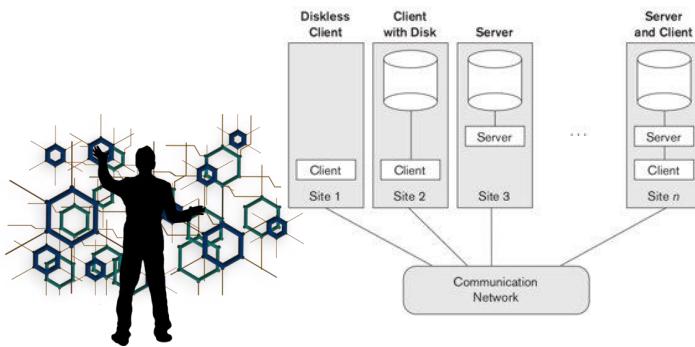
# Classificação

Big data

Replicação

DB federado

Heterogeneidade



Modelo de dados

Nº de usuários

Nº de sites

Custo

Tipo de caminho de acesso

# Classificação



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Módulos: replicação, paralelismo ....



Modelo de dados

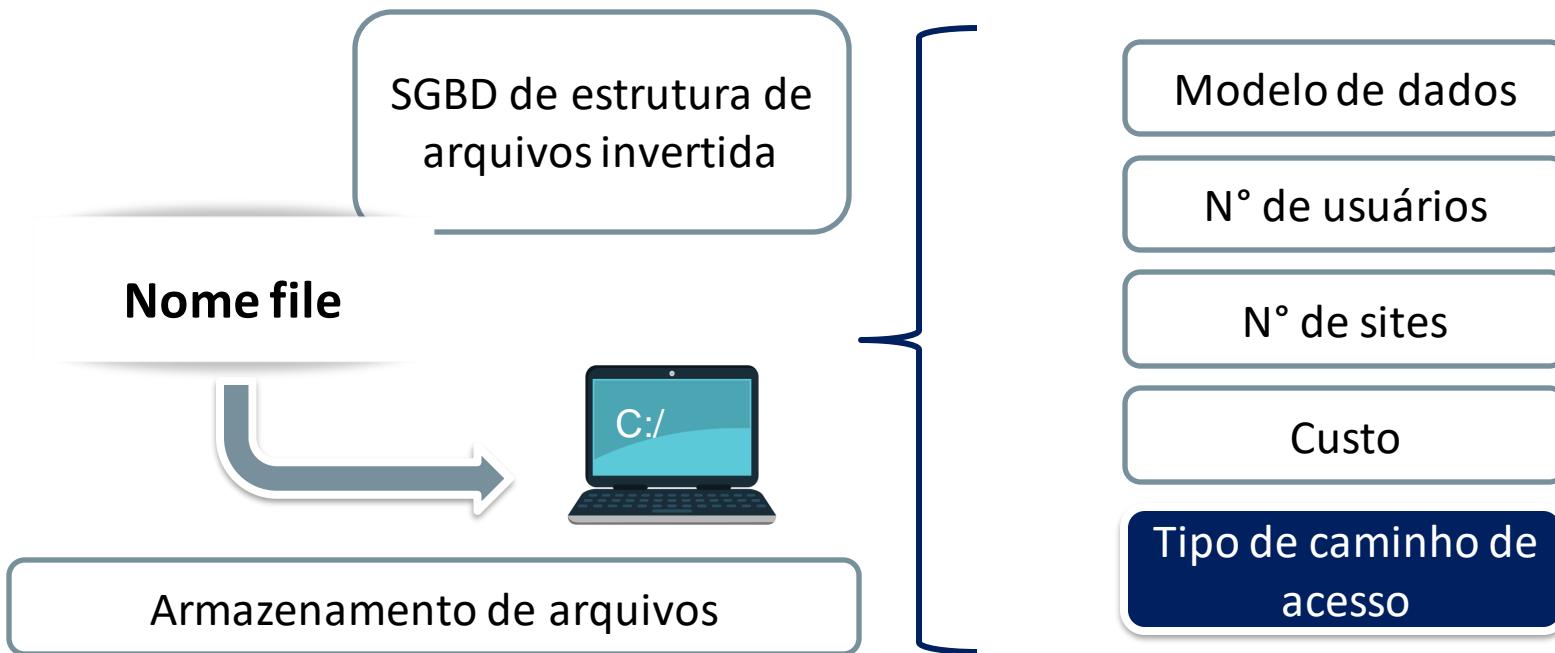
Nº de usuários

Nº de sites

Custo

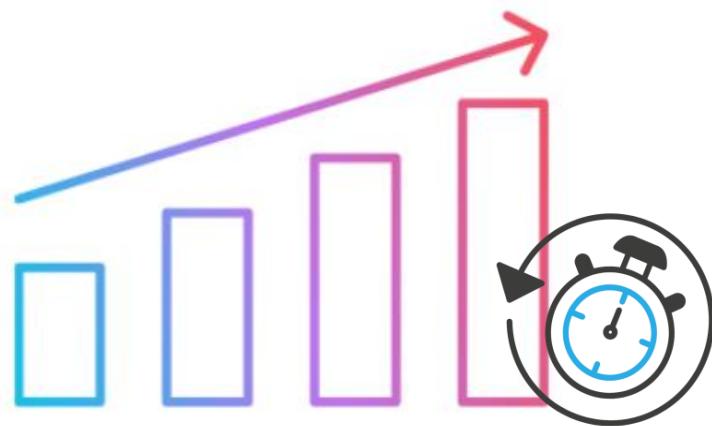
Tipo de caminho de  
acesso

# Classificação



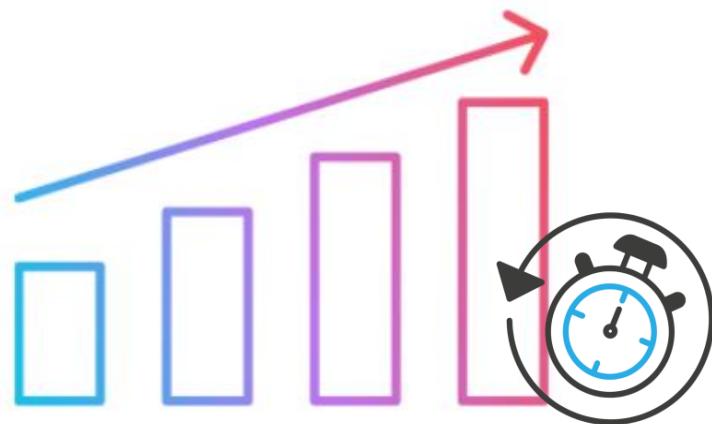
# Classificação

Performance



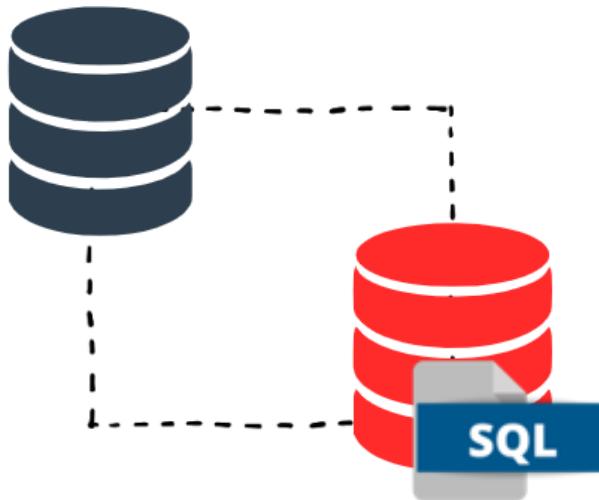
SGBD de Propósito Geral

# Classificação



SGBD de Propósito Geral

# Classificação - Relacional



Coleções de tabelas

Tabela



File

Alto Nível

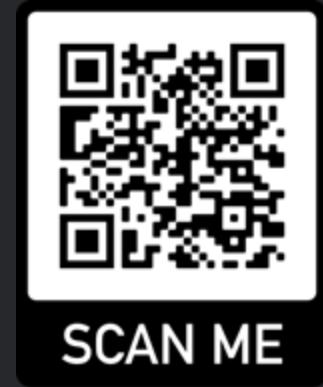
View



User

# Dúvidas?

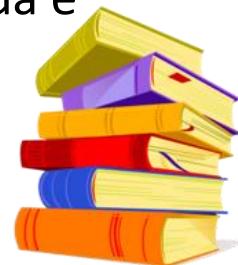
- > Fórum/Artigos
- > Comunidade Online (Discord)



# Para saber mais

Referências principais:

- Referência bibliográfica: Fundamentals of Database Systems – Navathe, 7º edição editora: Pearson
- Projeto de banco de dados: Uma visão prática - Edição revisada e ampliada - Machado 17º edição, editora: Saraiva



# Para saber mais

Outras referências:

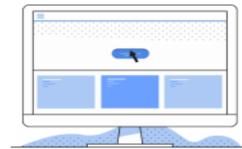
<https://www.ime.usp.br/~andrers/aulas/bd2005-1/aula3>

<https://www.devmedia.com.br/a-historia-dos-banco-de-dados/1678>

<https://db-engines.com/en/ranking>

<https://www.opservices.com.br/banco-de-dados/>

<https://www.quora.com/What-is-a-canned-transaction>

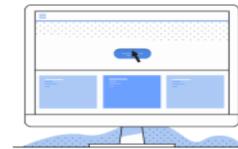


# Para saber mais

Outras referências:

<https://www.geeksforgeeks.org/impedance-mismatch-in-dbms/#:~:text=Impedance%20mismatch%20is%20the%20term,Attributes%20and%20their%20data%20types>

<https://www.oreilly.com/library/view/mysql-reference-manual/0596002653/ch03s05.html>



# Para saber mais

Outras referências:

<https://docs.oracle.com/pt-br/solutions/deploy-lustre-fs/index.html#:~:text=Lustre%C3%A9um%20sistema%20de,do%20Linux%20e%20do%20cluster.>

<https://stackoverflow.com/questions/1075074/opinions-on-netcdf-vs-hdf5-for-storing-scientific-data#:~:text=NetCDF%20starting%20with%20version%204.0,a%20much%20wider%20tool%20base>



# Para saber mais

Empresas e SGBDs:

<https://www.quora.com/What-are-all-the-DBMS-that-are-being-used-by-Google-Facebook-and-Twitter-1>  
<https://introbigdata.org/>

<https://www.mongodb.com/big-data-explained/examples>  
<https://intellipaat.com/blog/10-big-data-examples-application-of-big-data-in-real-life/>

<https://instagram-engineering.com/instagration-pt-2-scaling-our-infrastructure-to-multiple-data-centers-5745cbad7834>



# Para saber mais

Empresas e SGBDs:

[https://blog.twitter.com/engineering/en\\_us/topics/infrastructure/2017/the-infrastructure-behind-twitter-scale#:~:text=Twitter%20was%20built%20on%20MySQL,many%20large%20database%20clusters.](https://blog.twitter.com/engineering/en_us/topics/infrastructure/2017/the-infrastructure-behind-twitter-scale#:~:text=Twitter%20was%20built%20on%20MySQL,many%20large%20database%20clusters.)

<https://www.mysql.com/customers/view/?id=757>

<https://engineering.linkedin.com/espresso/introducing-espresso-linkedins-hot-new-distributed-document-store#:~:text=To%20meet%20the%20needs%20of,both%20serving%20different%20use%20cases>



# Desafio textual

Defina!

- Dados e banco de dados
- SGBD, Sistema de Banco de Dados e Catálogo de BD
- Independência program/data, user view
- DBA, transações canned, metadados e aplicação de processamento de transação

# Desafio

