

# Introdução à Banco de dados

*Trilha de Banco de Dados Relacional*

**Juliana Mascarenhas**

Tech Education Specialist DIO / Owner @Simplificandoredes  
e @SimplificandoProgramação

Mestre em modelagem computacional | Cientista de dados

**@in/juliana-mascarenhas-ds/**



<https://github.com/julianazanelatto>

## **Juliana Mascarenhas**

Tech Education Specialist

@SimplificandoRedes

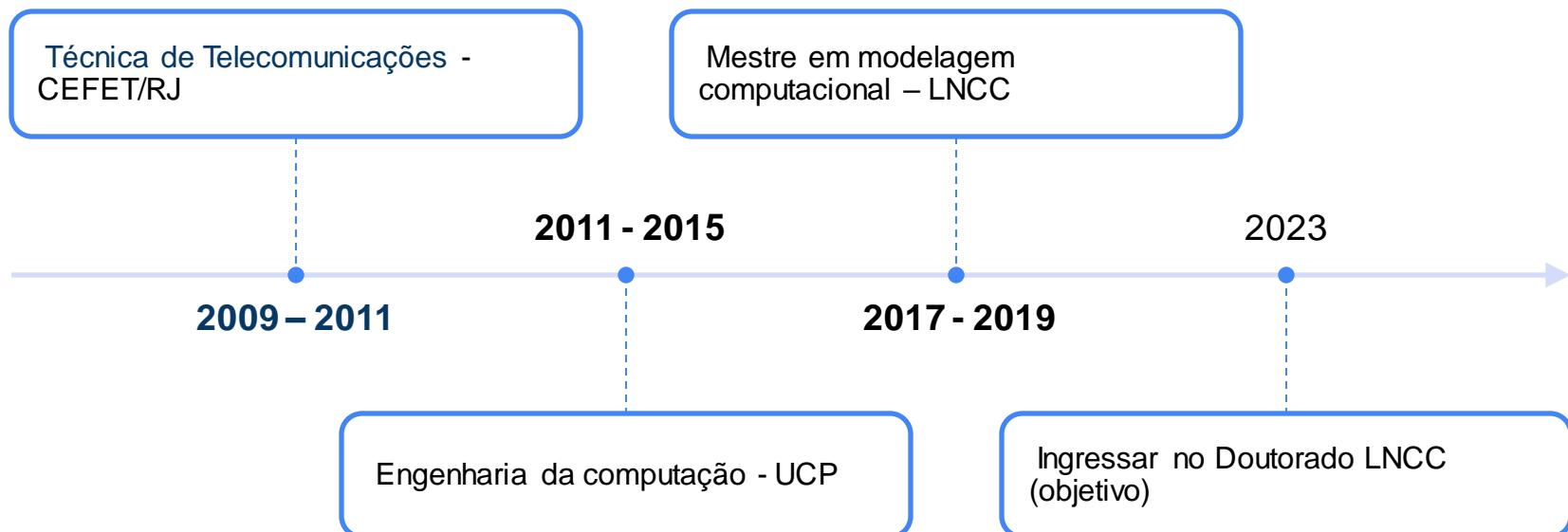
@SimplificandoProgramação

Cientista de dados

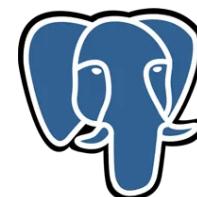
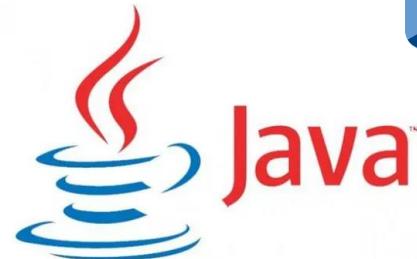
Desenvolvedora Java/Python

Me Modelagem Computacional - LNCC

# Sobre Mim



# Sobre Mim



PostgreSQL



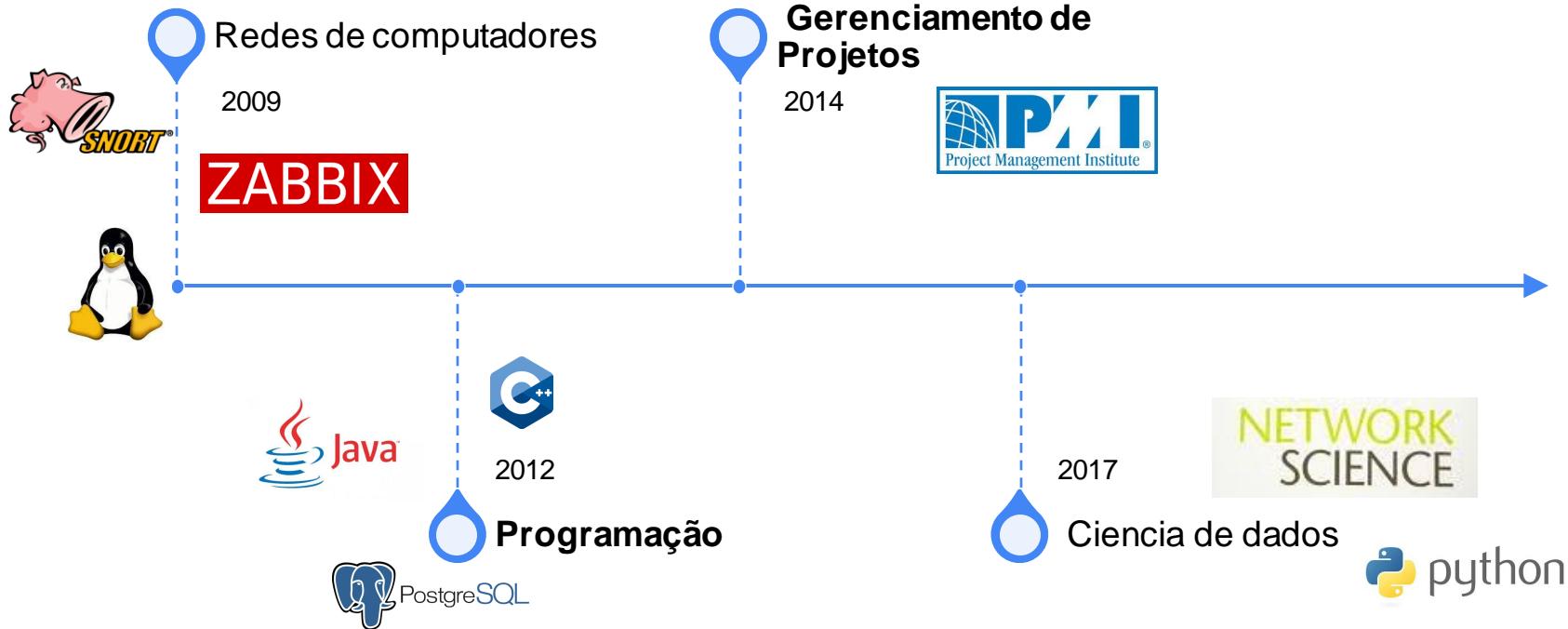
APACHE



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

[@in/juliana-mascarenhas-ds/](https://www.linkedin.com/in/juliana-mascarenhas-ds/)

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## Introdução à Programação e Pensamento Computacional

Curso base para iniciante

**Juliana Mascarenhas**

Tech Education Specialist / Sócia (Content Creator) @SimplificandoRedes

Me Modelagem Computacional / Cientista de dados

[@in/juliana-mascarenhas-ds/](https://www.linkedin.com/in/juliana-mascarenhas-ds/)



## 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

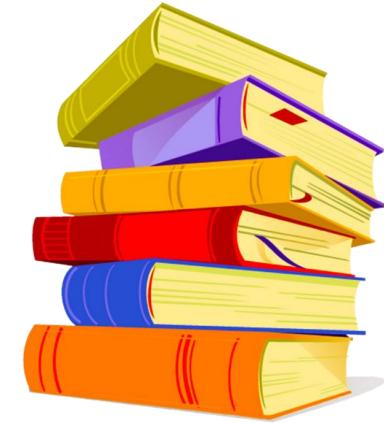


# Contextualizando



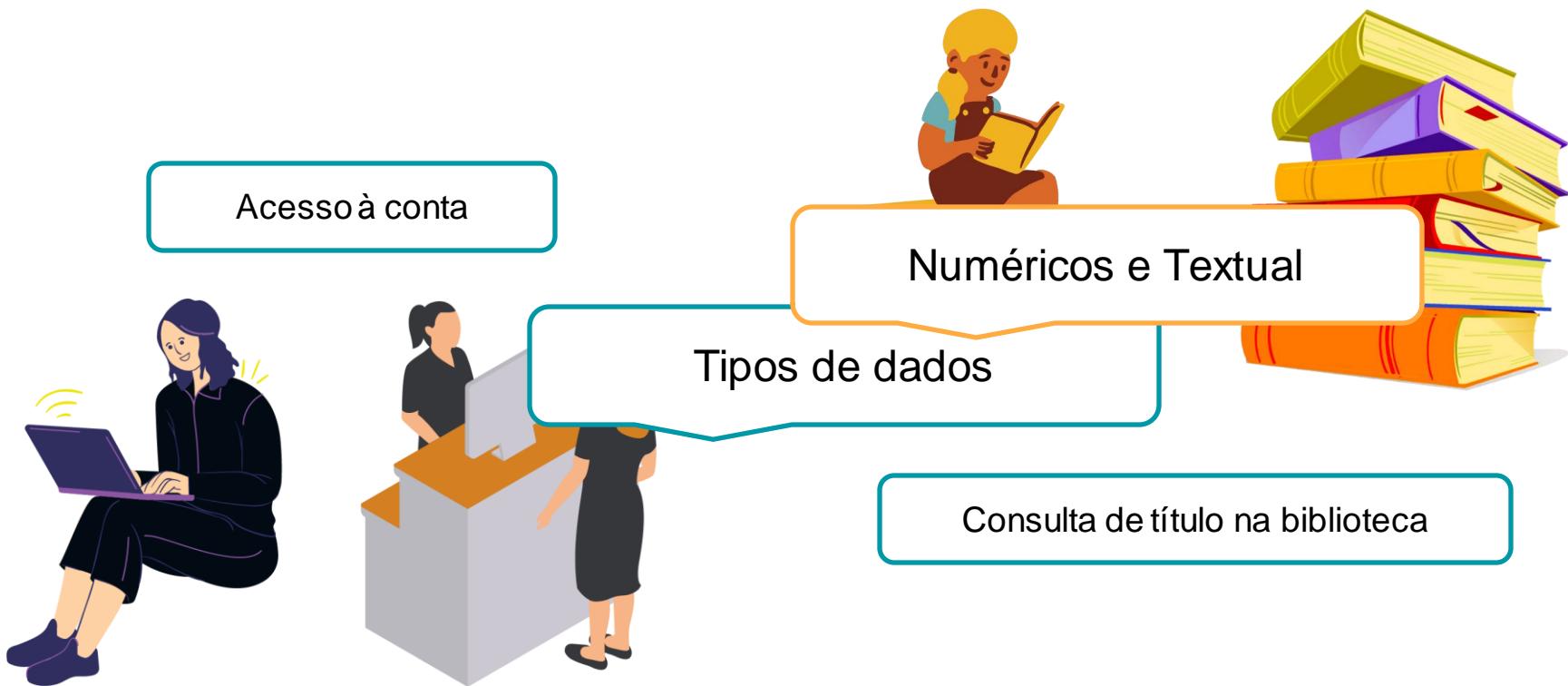
# Contextualizando

Acesso à conta

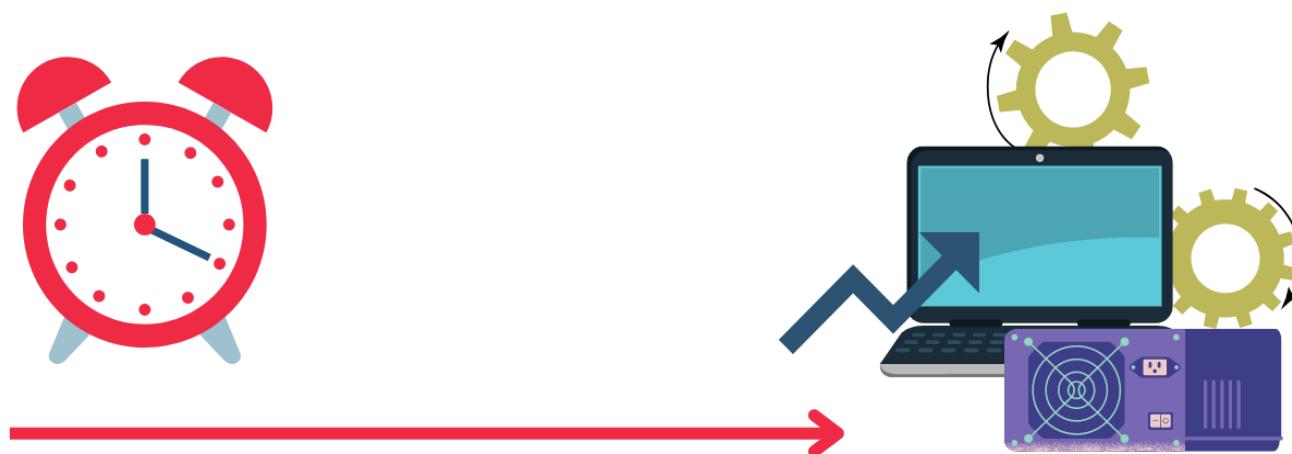


Consulta de título na biblioteca

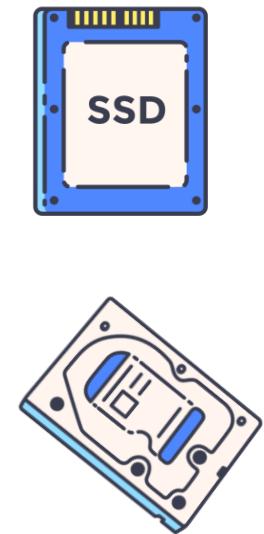
# Contextualizando



# Contextualizando



# Contextualizando



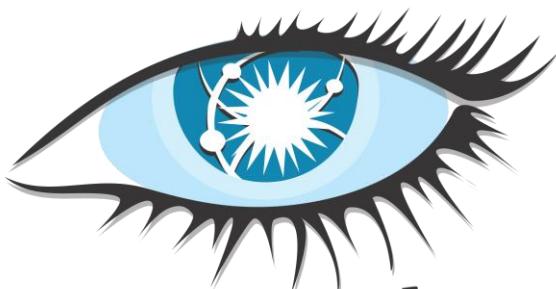
# Contextualizando



# Contextualizando



# Contextualizando



*cassandra*



mongoDB®



redis

# O que são banco de dados?



# O que são Banco de Dados?

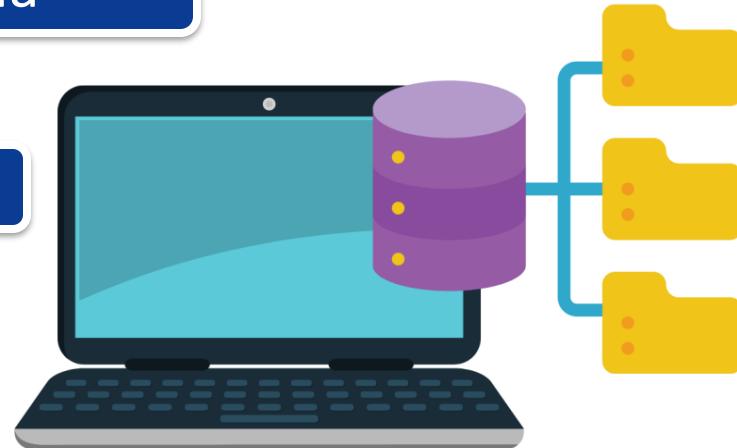
Negócios

E-commerce

Engenharia

Medicina

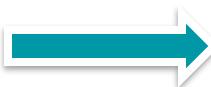
Social Media



# 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

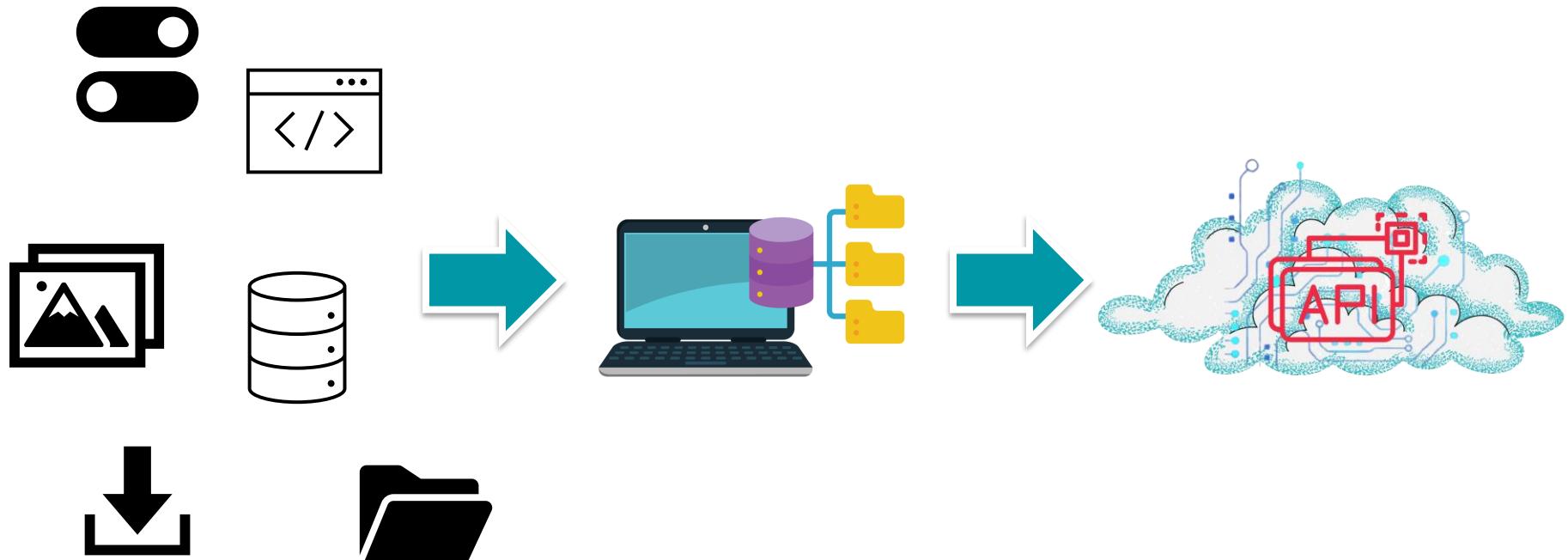
# O que são Banco de Dados?



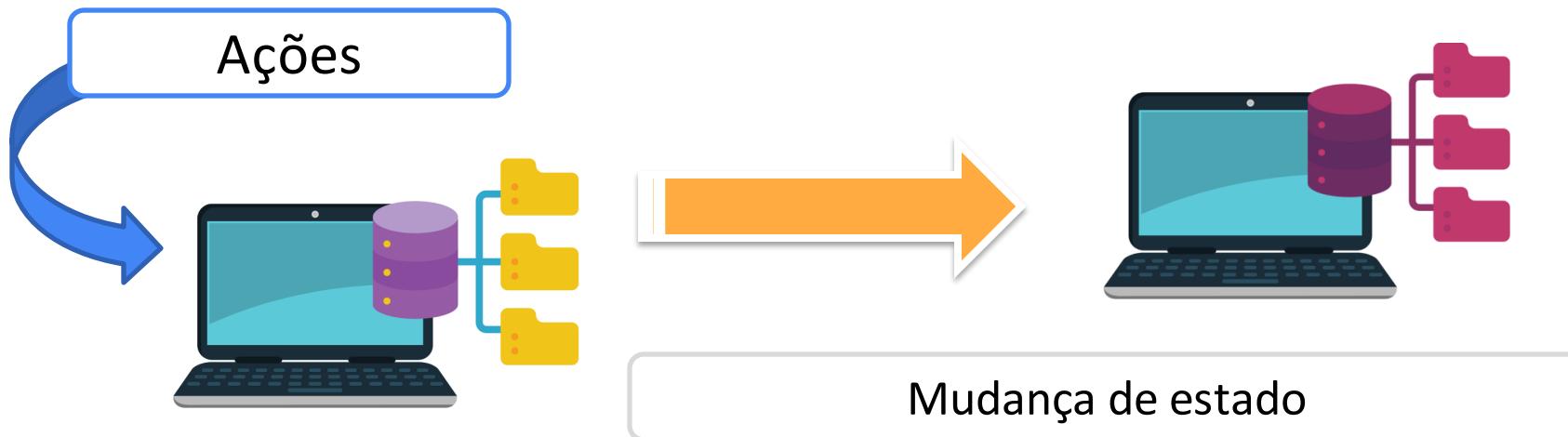
- Contexto - representação do mundo real;
- Coerência;
- Propósito

Uso + restrito

# O que são Banco de Dados?



# O que são Banco de Dados?

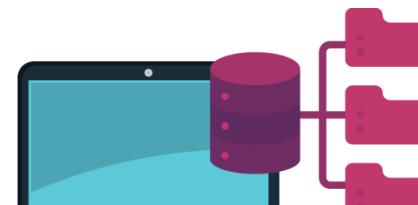
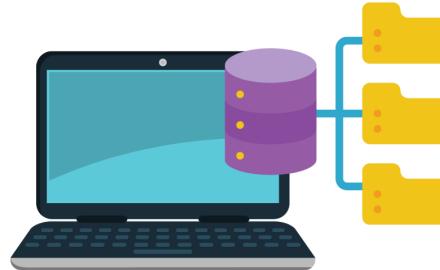


# O que são Banco de Dados?

Confiável

Acurado

Ações



Mudança de estado

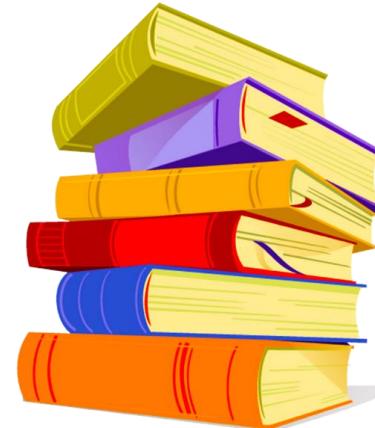
Reflexo "imediato"

# O que são Banco de Dados?

Tamanho?



Centenas



Bilhões



# O que são Banco de Dados?



friends



Complexidade

Manutenção do modelo e estado do bd

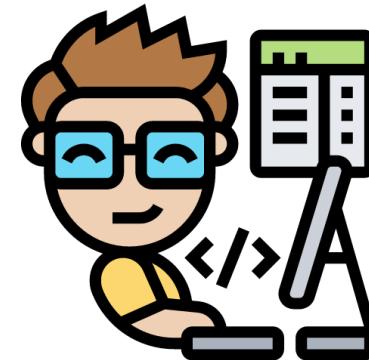
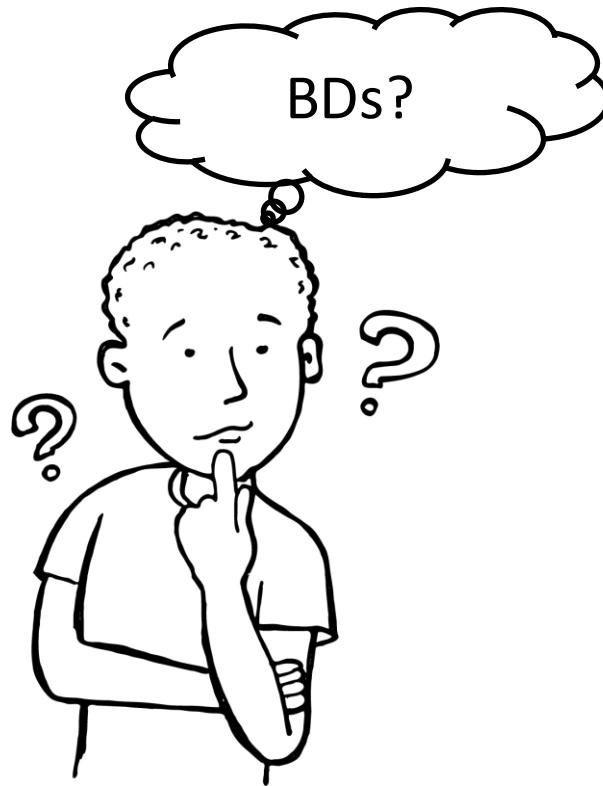
# O que são Banco de Dados?



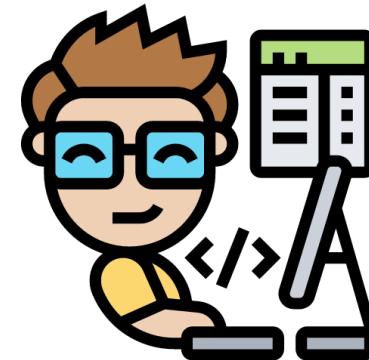
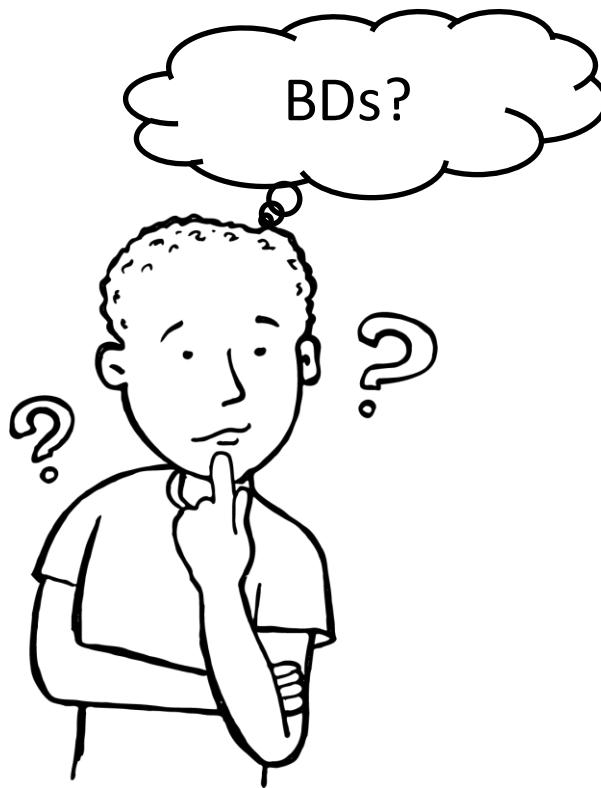
amazon

- 60 milhões de users
- 42 Terabytes
- SGBD distribuído

# O que são Banco de Dados?



# O que são Banco de Dados?

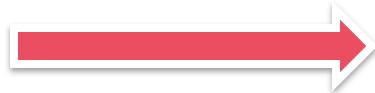


# SGBDs - Sistemas de Gerenciamento de Banco de Dados



# SGBDs

- Definição
- Construção
- Manipulação
- Compartilhamento



Tipo de dados

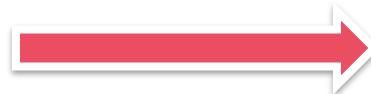
Estrutura

Constrains

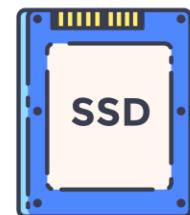
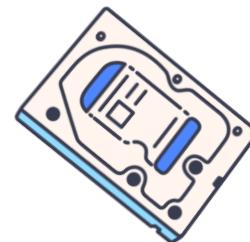
Software de propósito geral

# SGBDs

- Definição
- Construção
- Manipulação
- Compartilhamento



Inserção de dados



Software de propósito geral

# SGBDs

- Definição
- Construção
- Manipulação
- Compartilhamento

Recuperação

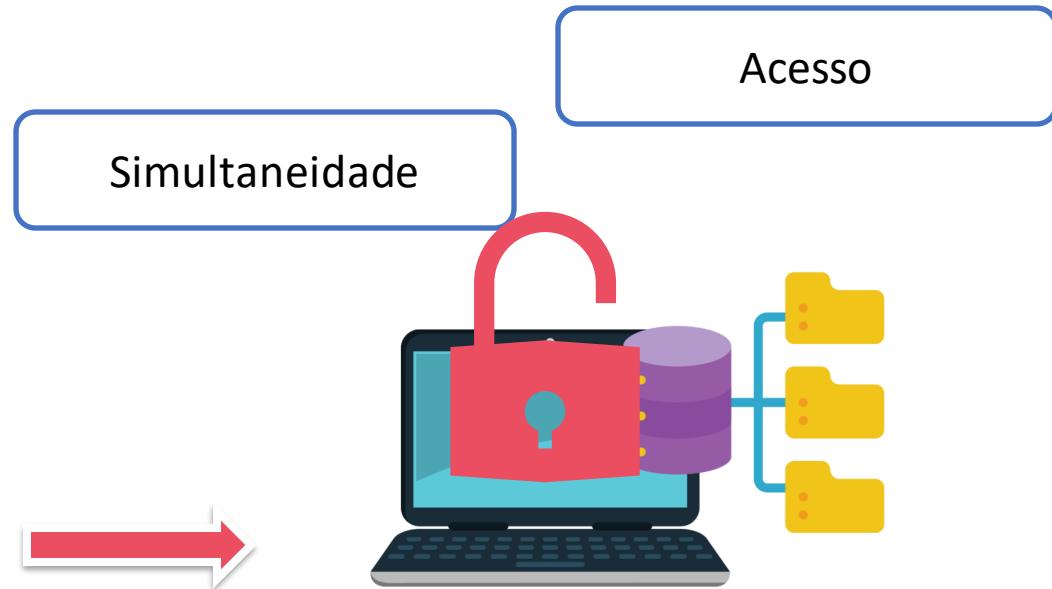
Relatórios



Software de propósito geral

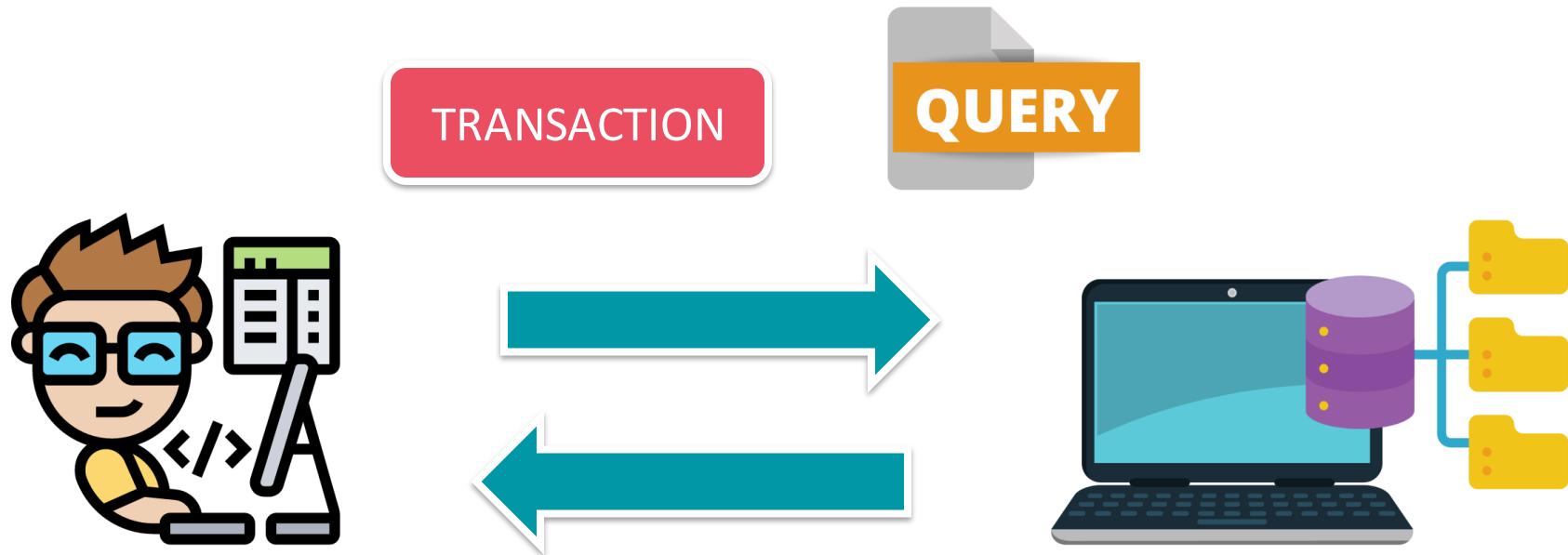
# SGBDs

- Definição
- Construção
- Manipulação
- Compartilhamento



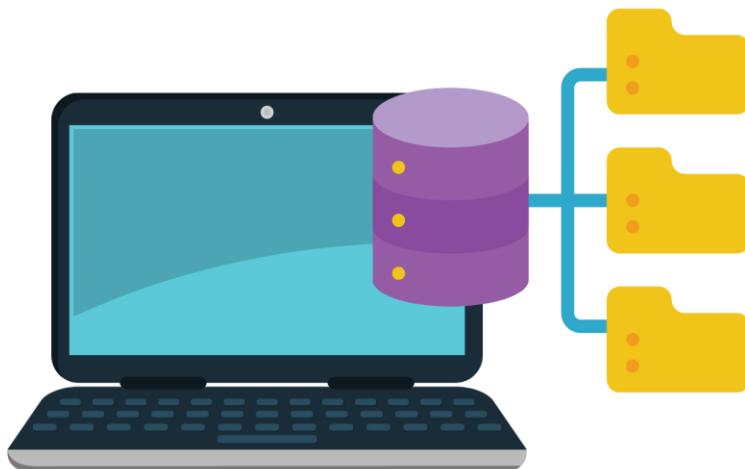
Software de propósito geral

# SGBDs



Retorno: dados

# SGBDs



Além disso ...

Acesso

Mal funcionamento

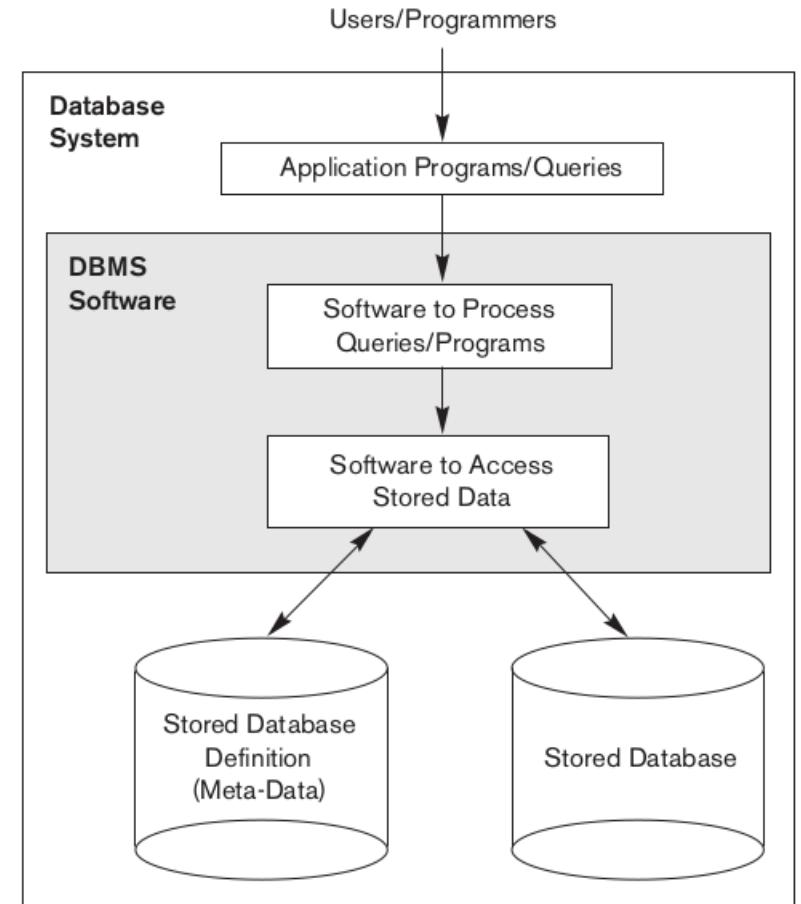
Proteção

Ciclo de vida de longo prazo

# SGBDs - Exemplo

Contexto: Universidade

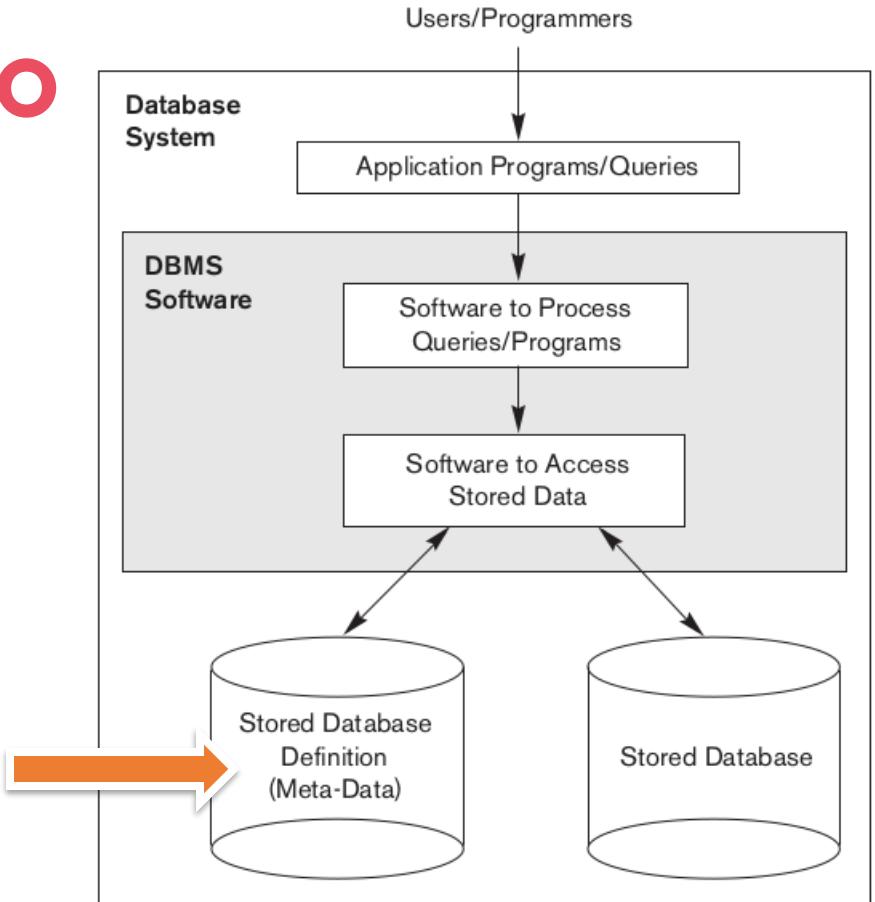
- Nome completo
- Matrícula
- Endereço
- Campus
- Curso
- Telefone
- Email
- ...



# 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
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Data Structures	CS3320	4	CS
Discrete Mathematics	MATH2410	3	MATH
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**GRADE\_REPORT**

Student_number	Section_identifier	Grade
17	112	B
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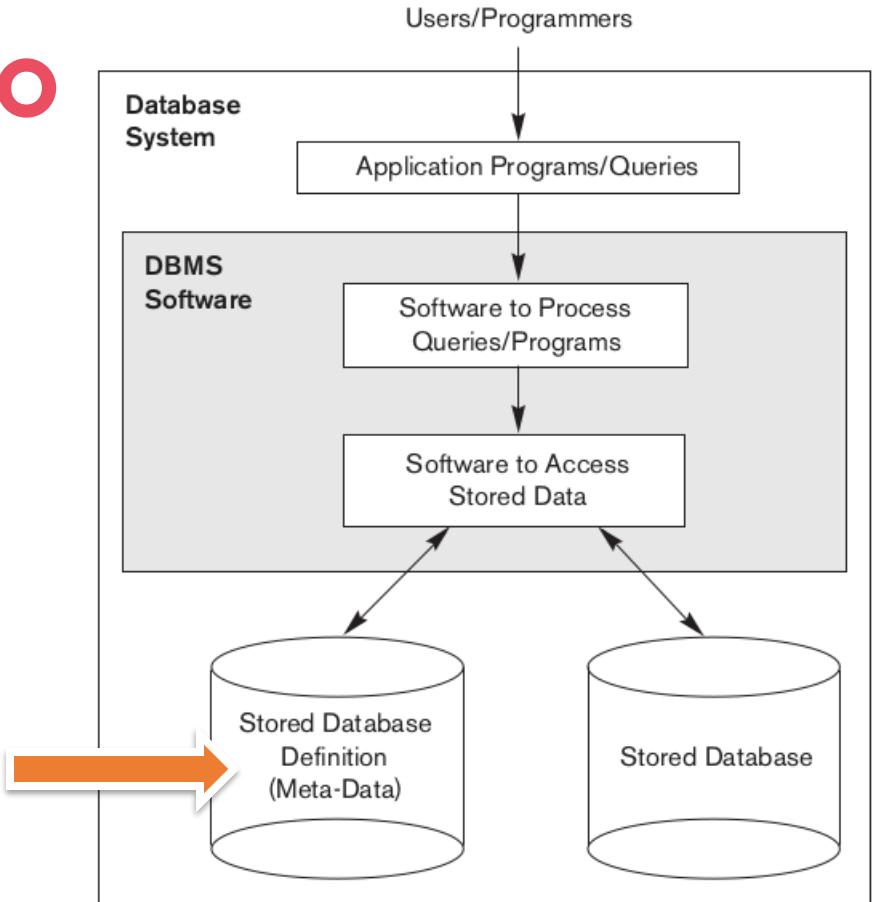
**PREREQUISITE**

Course_number	Prerequisite_number
CS3380	CS3320
CS3380	MATH2410
CS3320	CS1310

# SGBDs - Exemplo

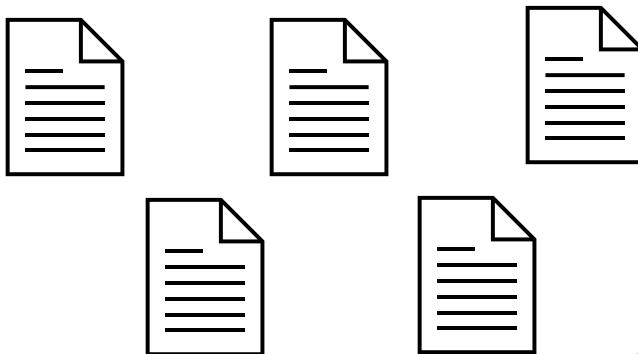
## Metadados

Informações que fornecem uma descrição concisa dos dados contidos no BD

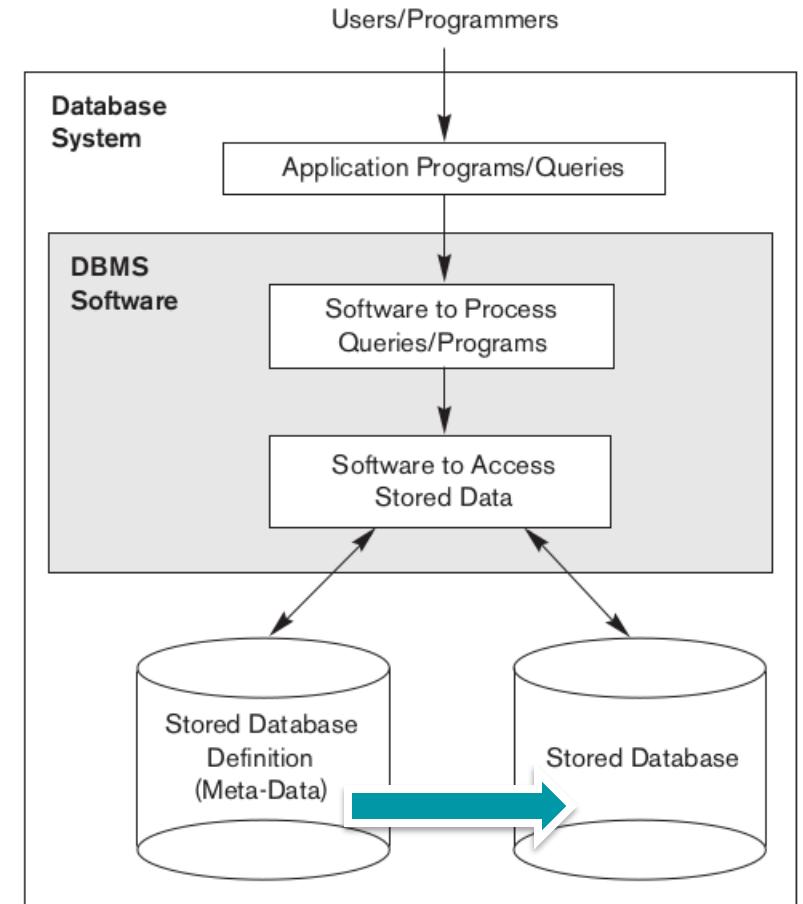


# SGBDs - Exemplo

Construção



Arquivos

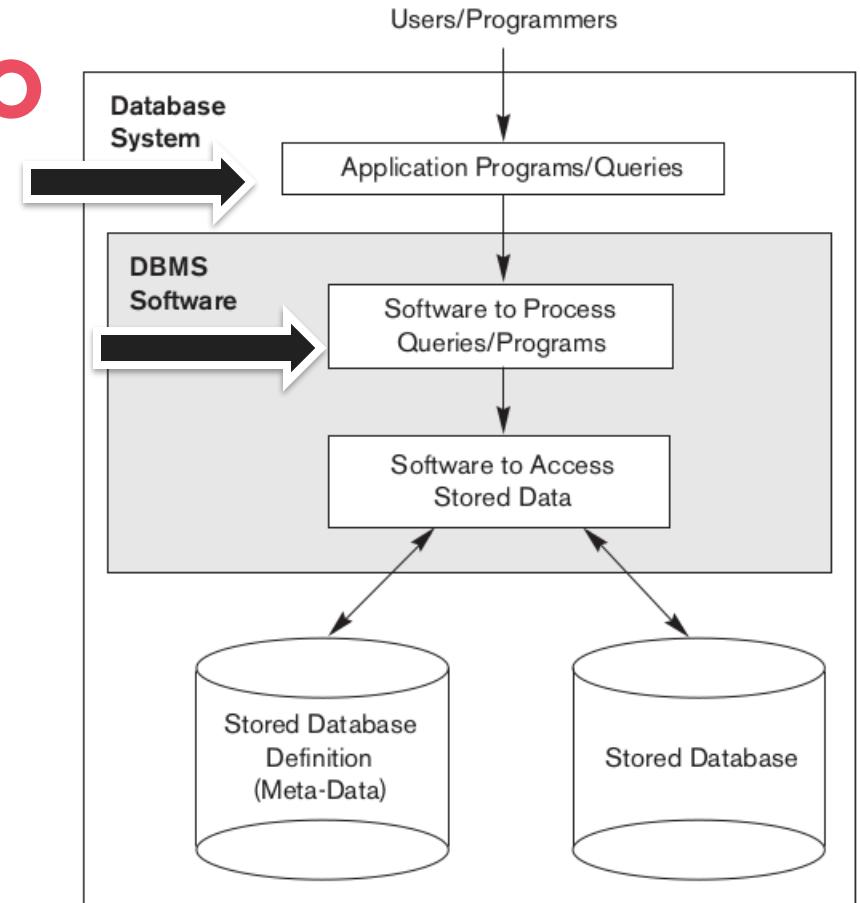


# SGBDs - Exemplo

Manipulação

QUERY

Updates

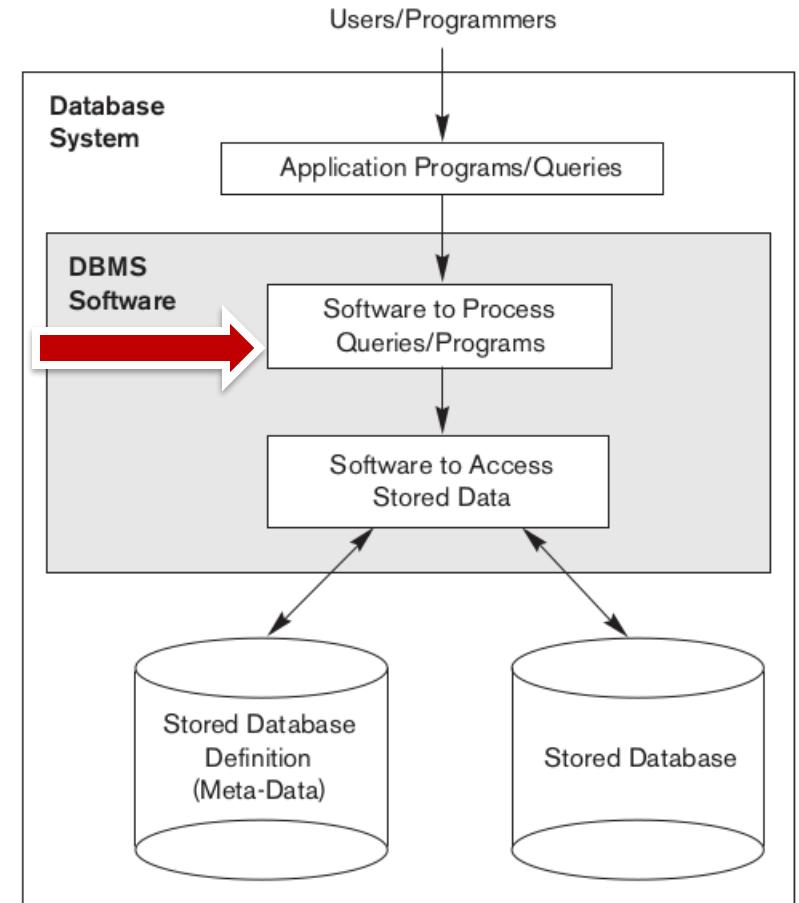


# SGBDs - Exemplo

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

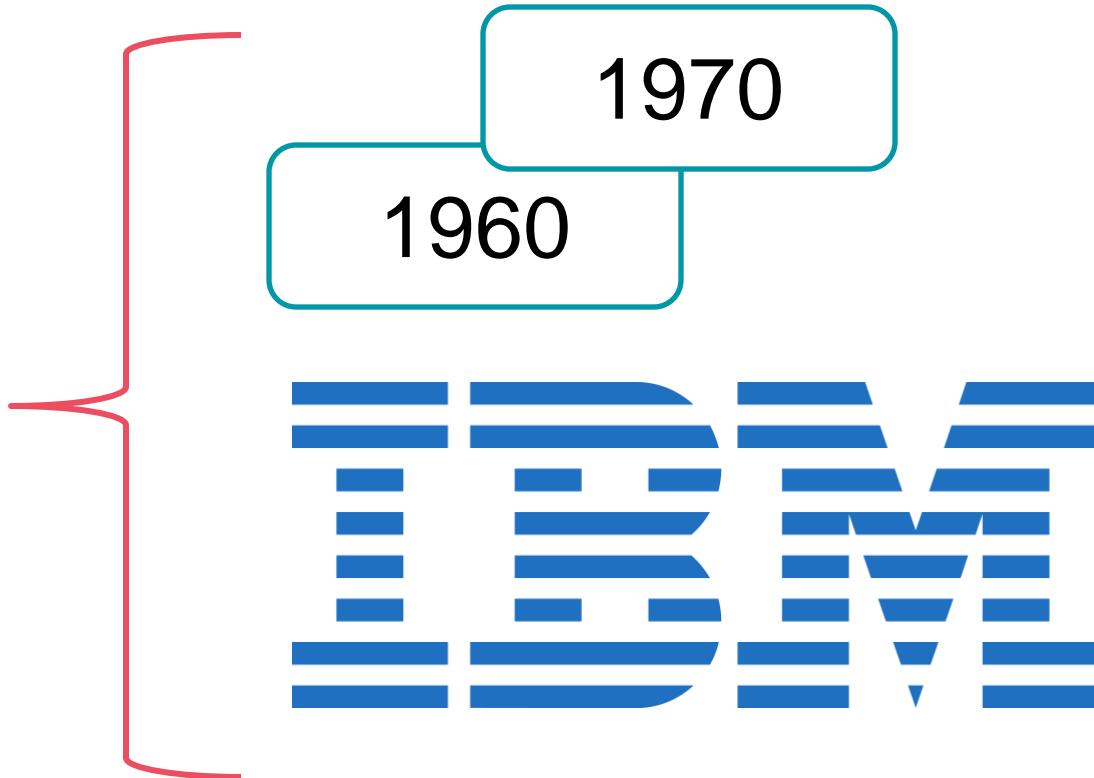
Sistemas de Gerenciamento de BDs mais utilizados

Visão geral de características e propriedades

## Modelo de BD Relacional

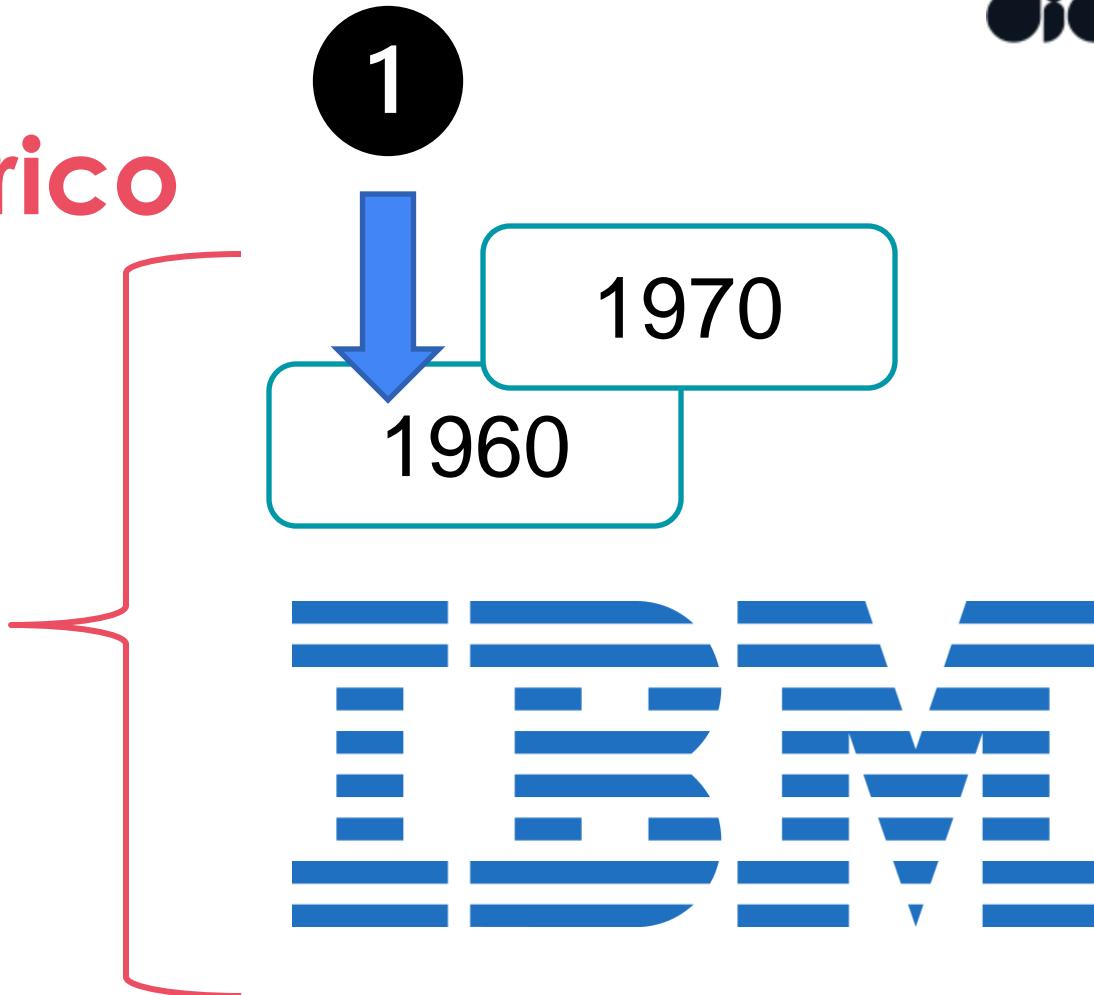
# Breve Histórico

Modelo Relacional  
de BDs

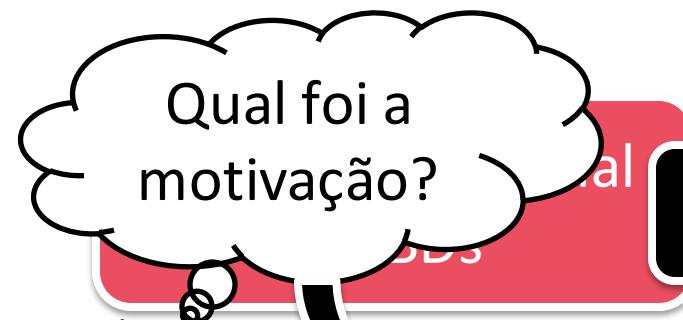


# Breve Histórico

Modelo Relacional  
de BDs



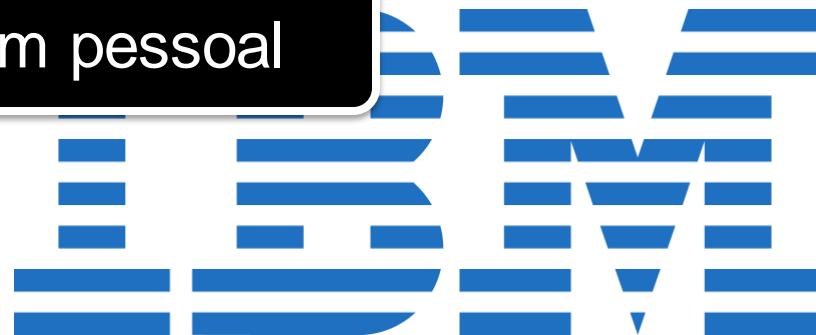
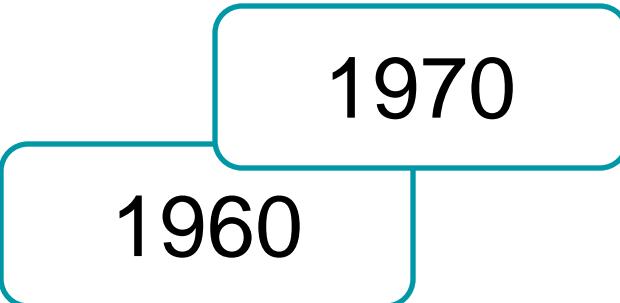
# Breve Histórico



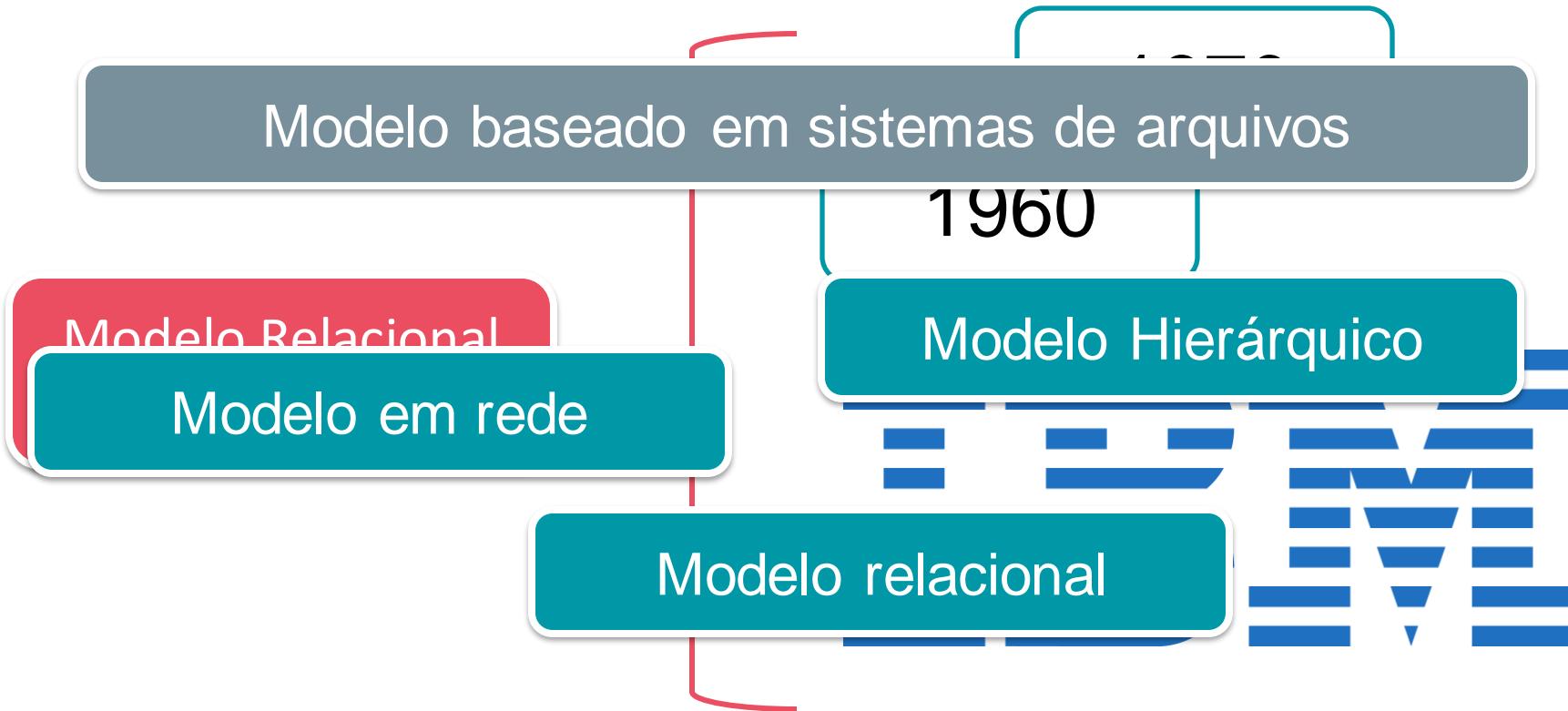
Custo com pessoal

1960

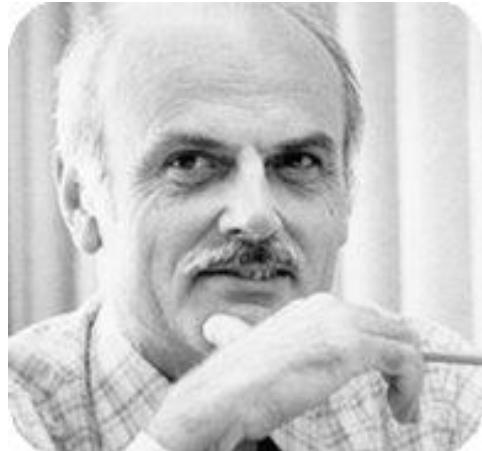
1970



# Breve Histórico



# Breve Histórico



Criador: Ted Codd

Cálculo e Álgebra Relacional

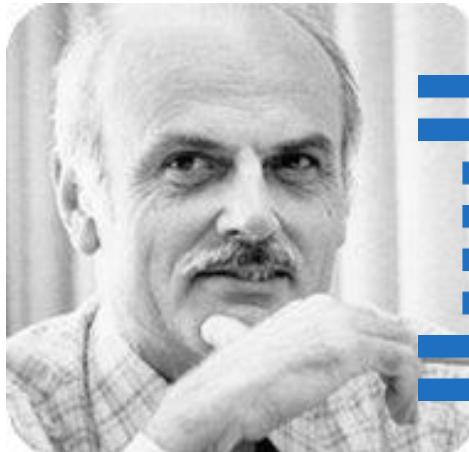


Artigo

1970

# Breve Histórico

Cálculo e Álgebra Relacional

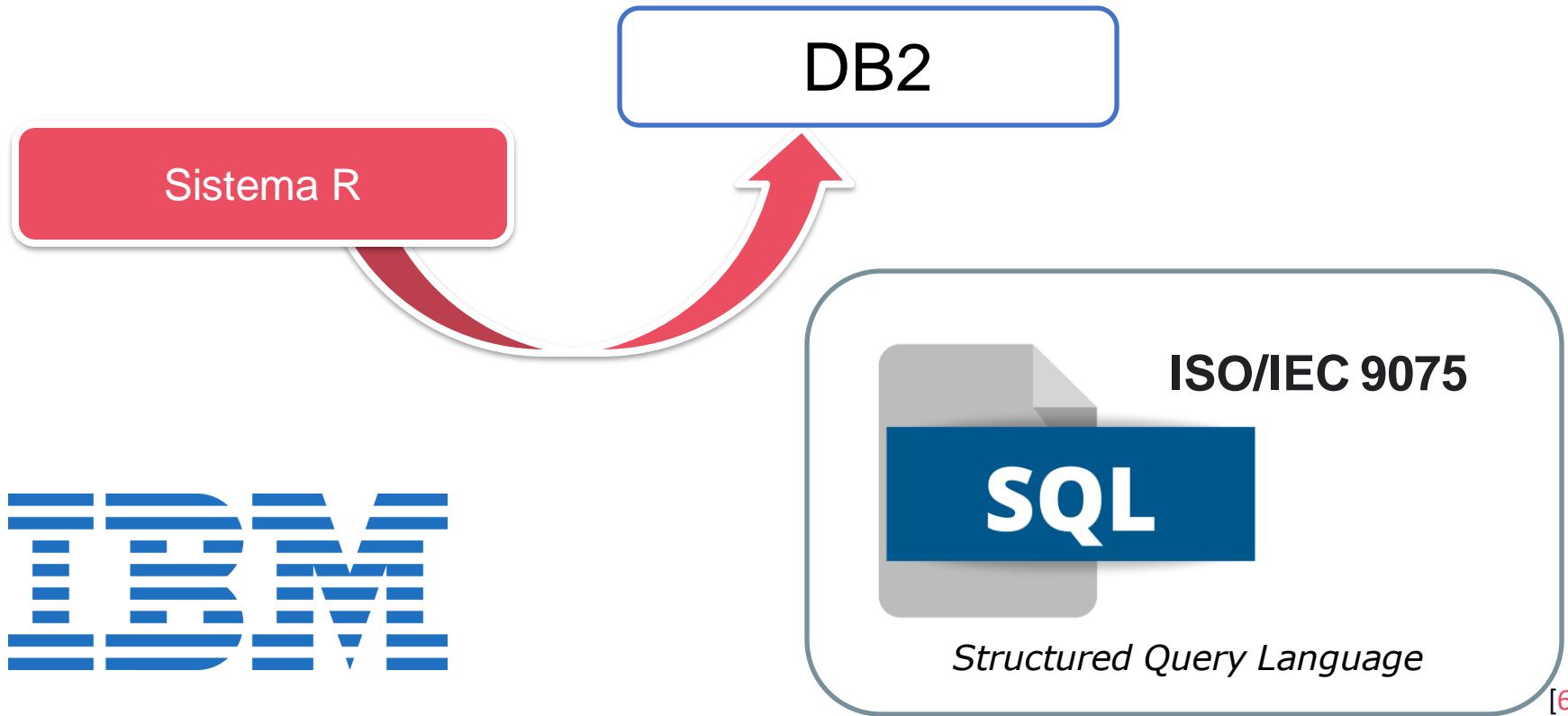


Criador: Ted Codd

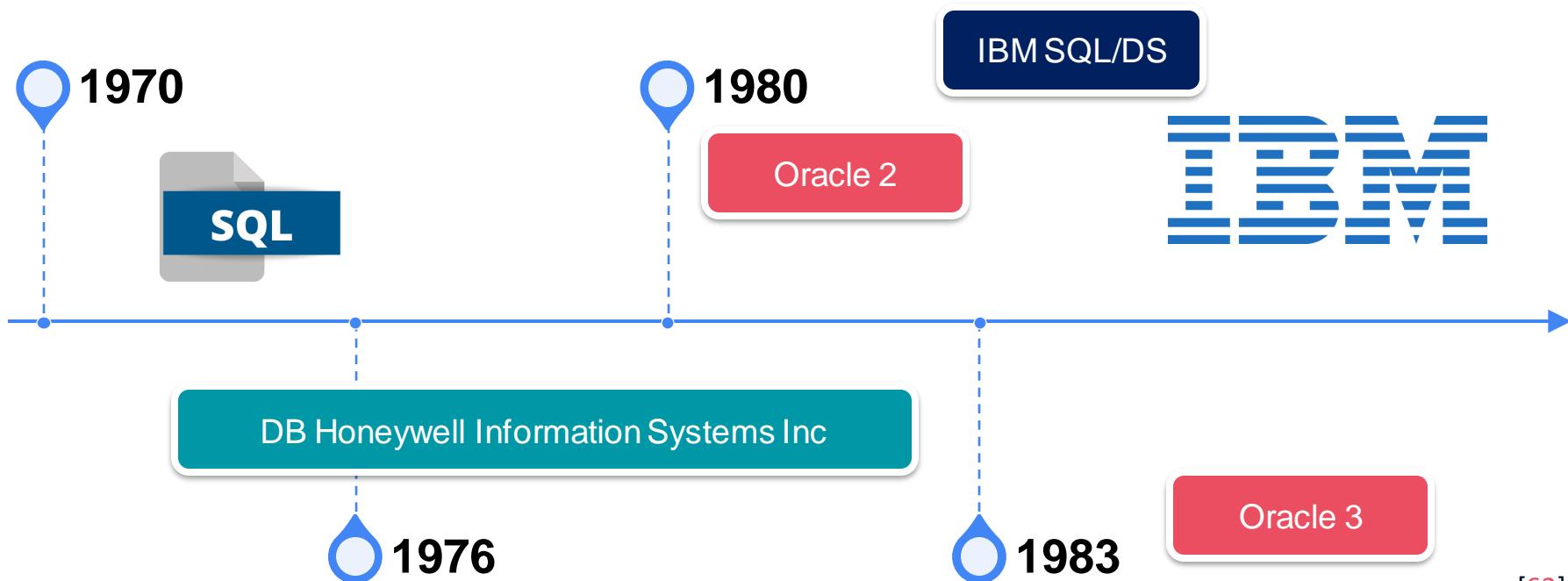
Artigo

1970

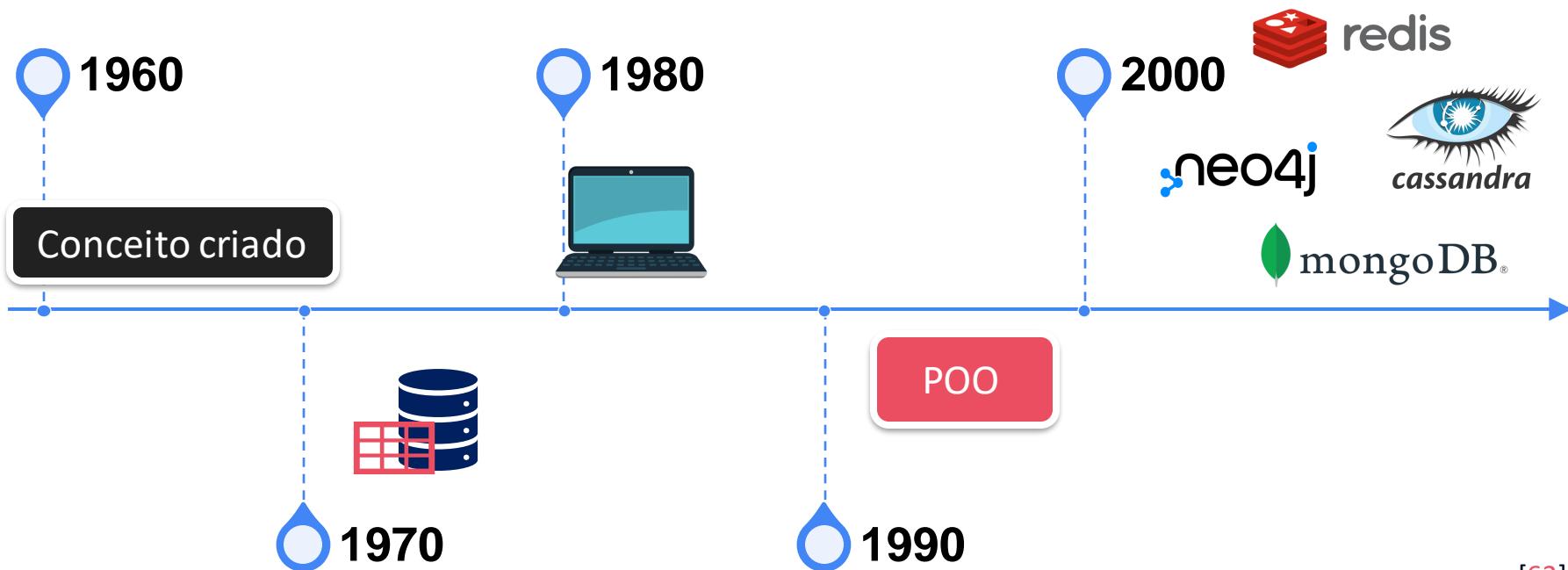
# Breve Histórico



# 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

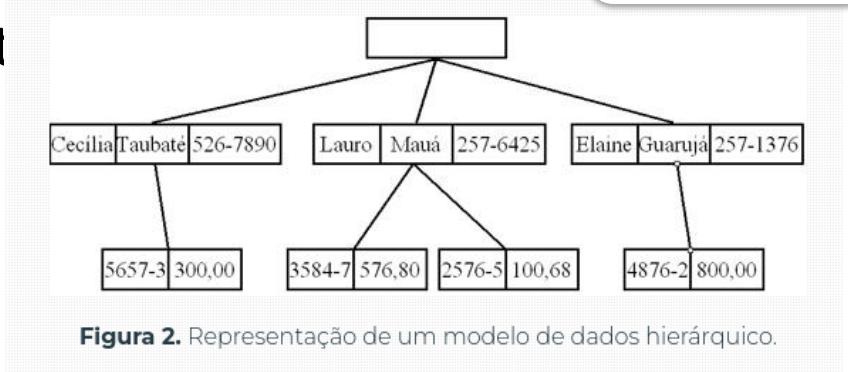
BDDBase

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

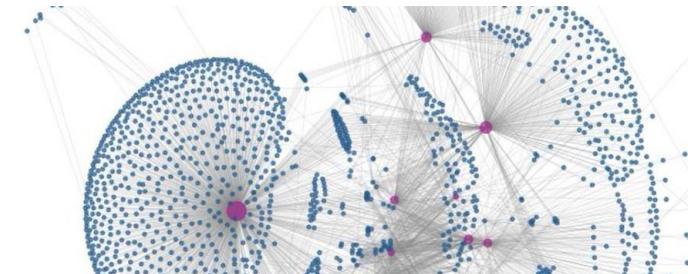
# Modelo em Rede

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

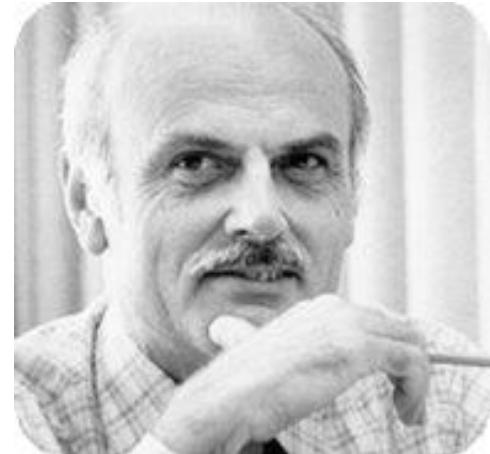
# Modelo de Banco de dados Relacional



# 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

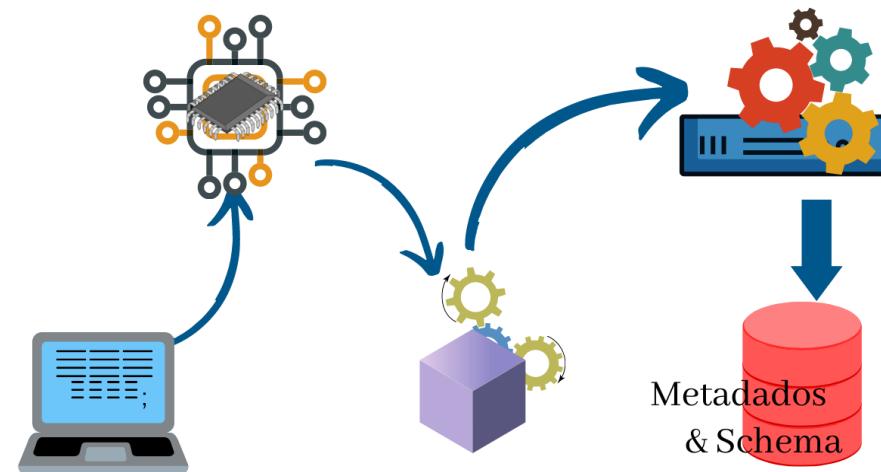
# Modelo Relacional

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

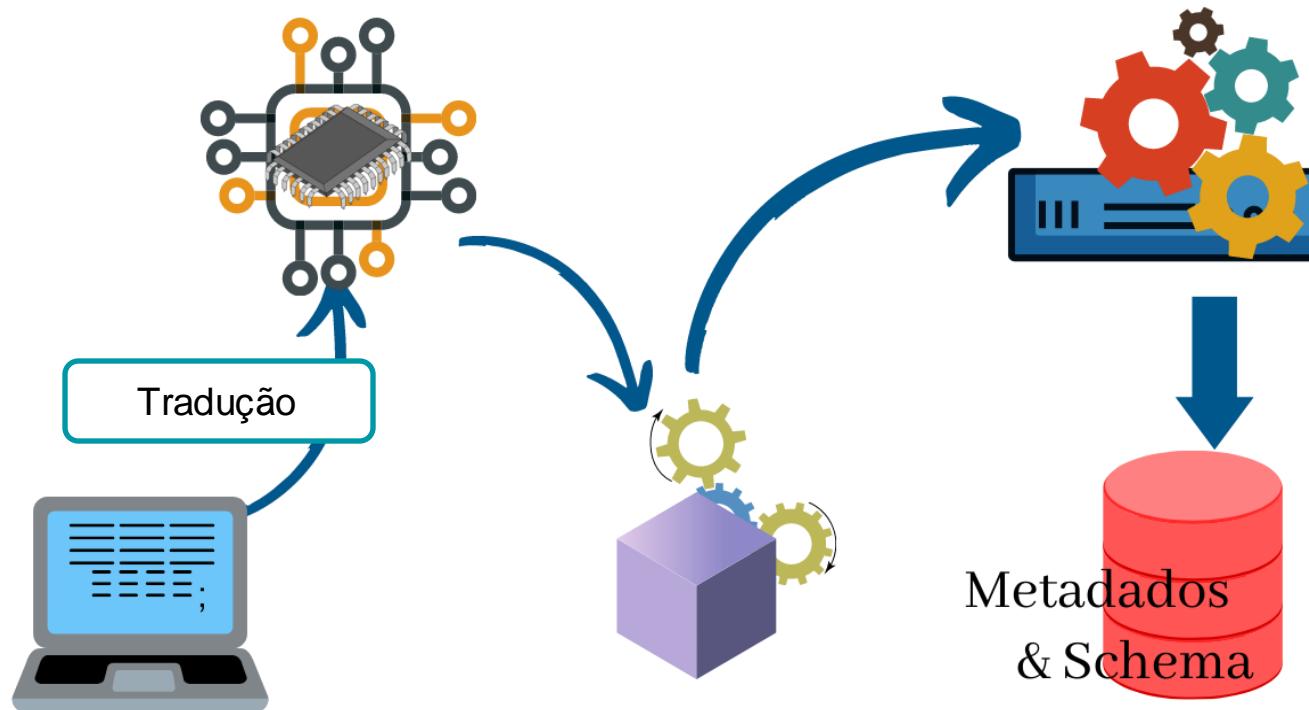


LDD – Linguagem de Definição de Dados

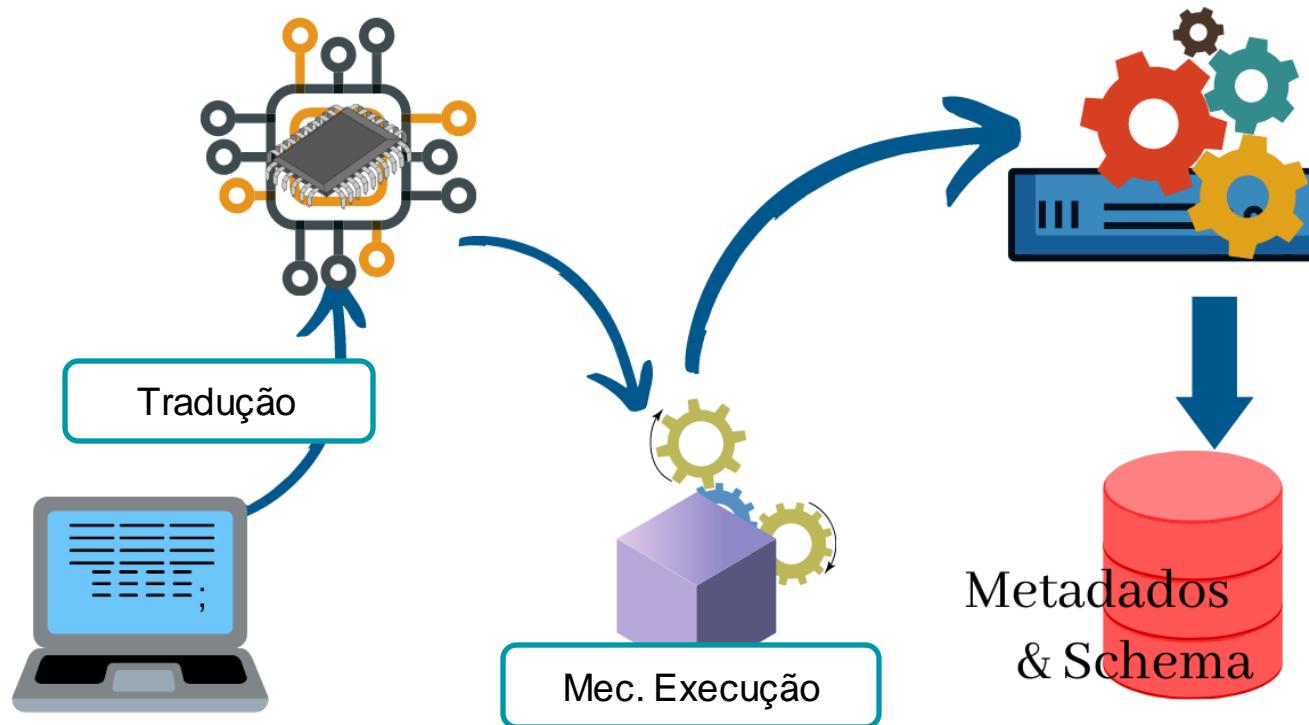
# Modelo Relacional



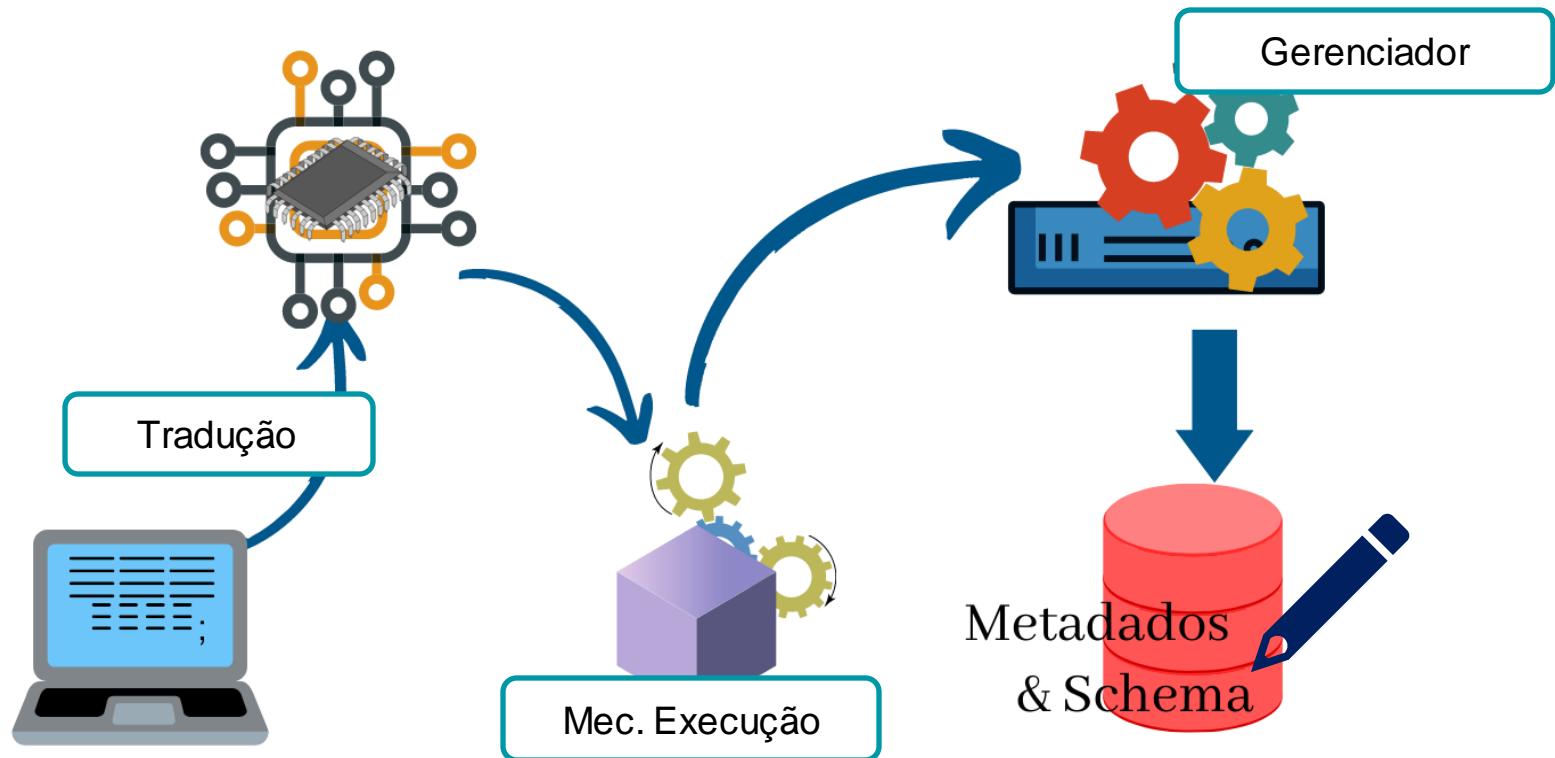
# Modelo Relacional



# 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

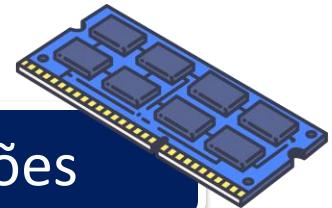


LMD – Linguagem de Definição de Dados

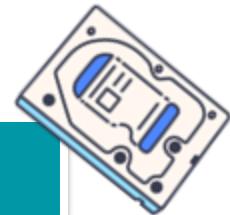
# Storage & Buffer

- Gerenciador de armazenamento
- Gerenciador de buffer

Ações



Dados



LMD – Linguagem de Definição de Dados

# Storage & Buffer

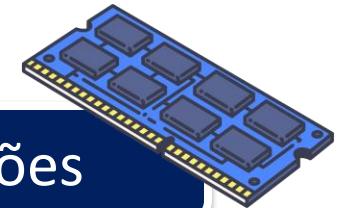
Movimento

- Gerenciador de armazenamento

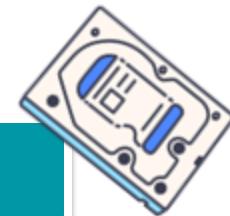
Troca

- Gerenciador de buffer

Ações

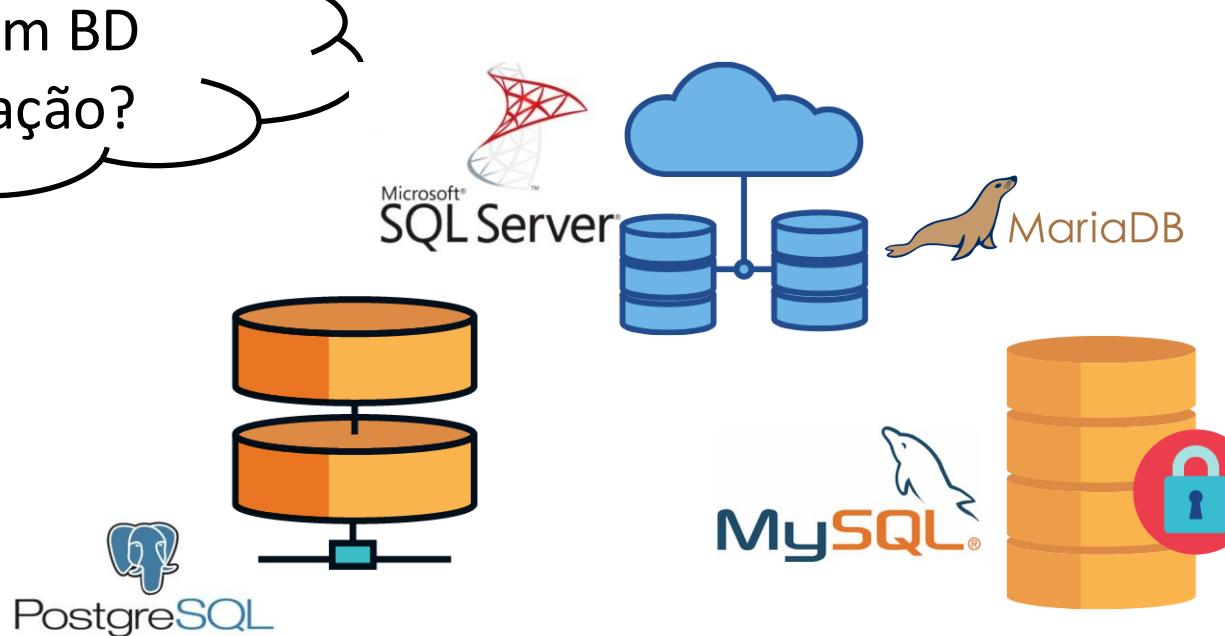
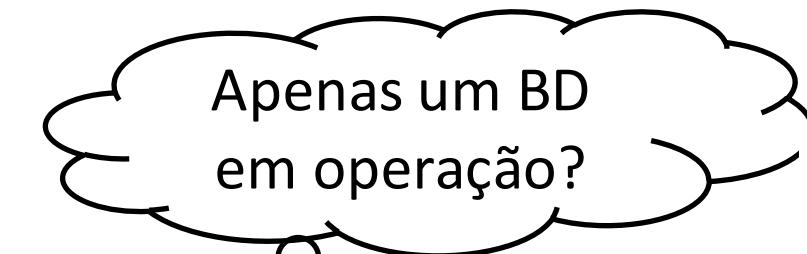


Dados

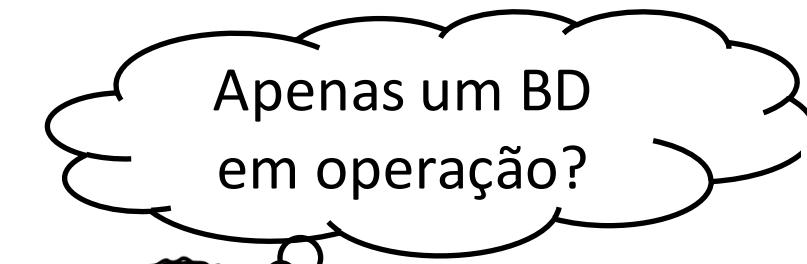


LMD – Linguagem de Definição de Dados

# 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®



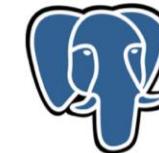
2

Microsoft®  
SQL Server®

3

T-SQL

4



PostgreSQL



mongoDB.®

5



redis

6

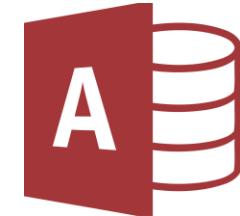
<https://db-engines.com/en/ranking>

# Mais utilizados pelo mercado



ElasticSearch

7



9

12



MariaDB



cassandra

11

# Mais utilizados pelo mercado

Popularidade

Tempo de marcado

Documentação

Robustez

Confiabilidade

Segurança

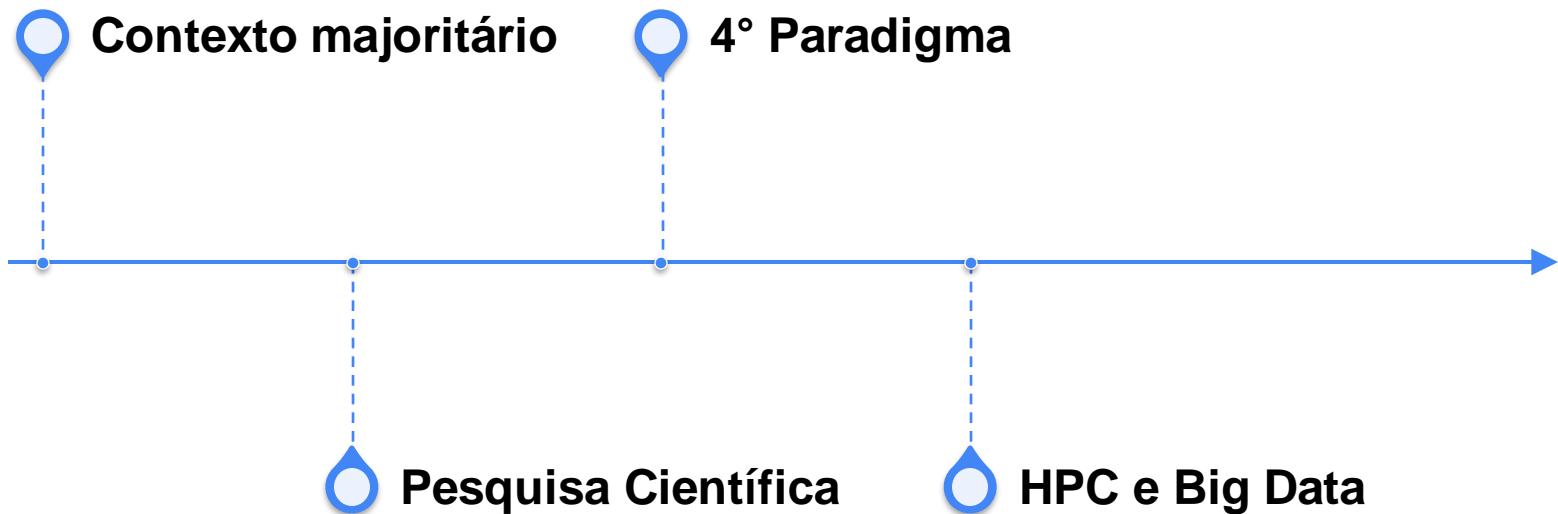
Multiplataforma

## 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



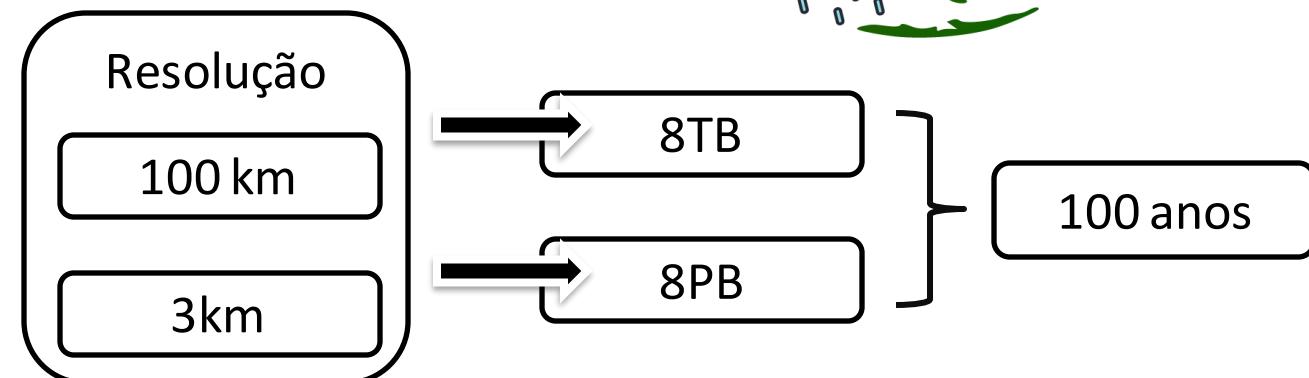
# Researching



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

# Researching

Exemplos

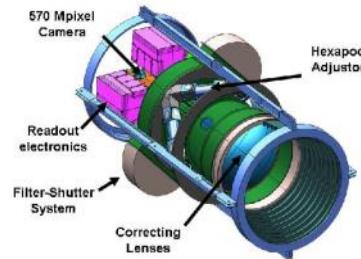


# Researching

## Exemplos



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

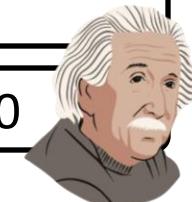


Mapeamento de galáxias,  
supernovas e padrões

6.6TB/dia

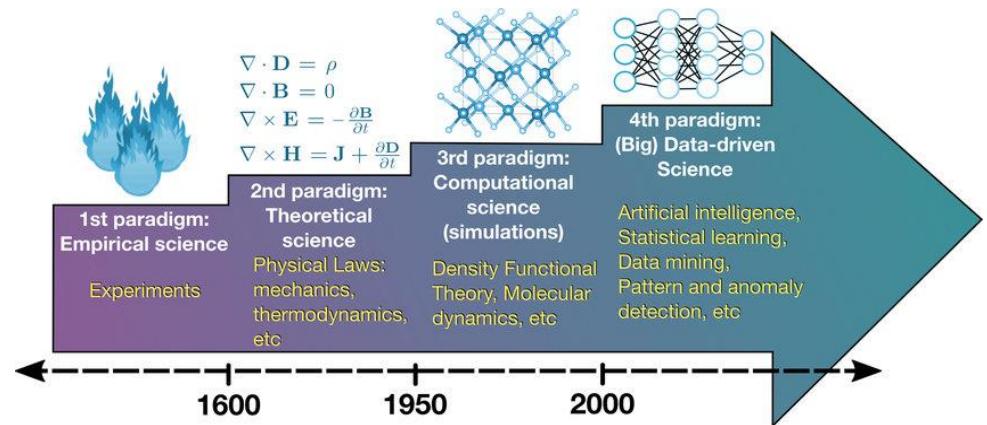
400

25 instituições



# 4º Paradigma

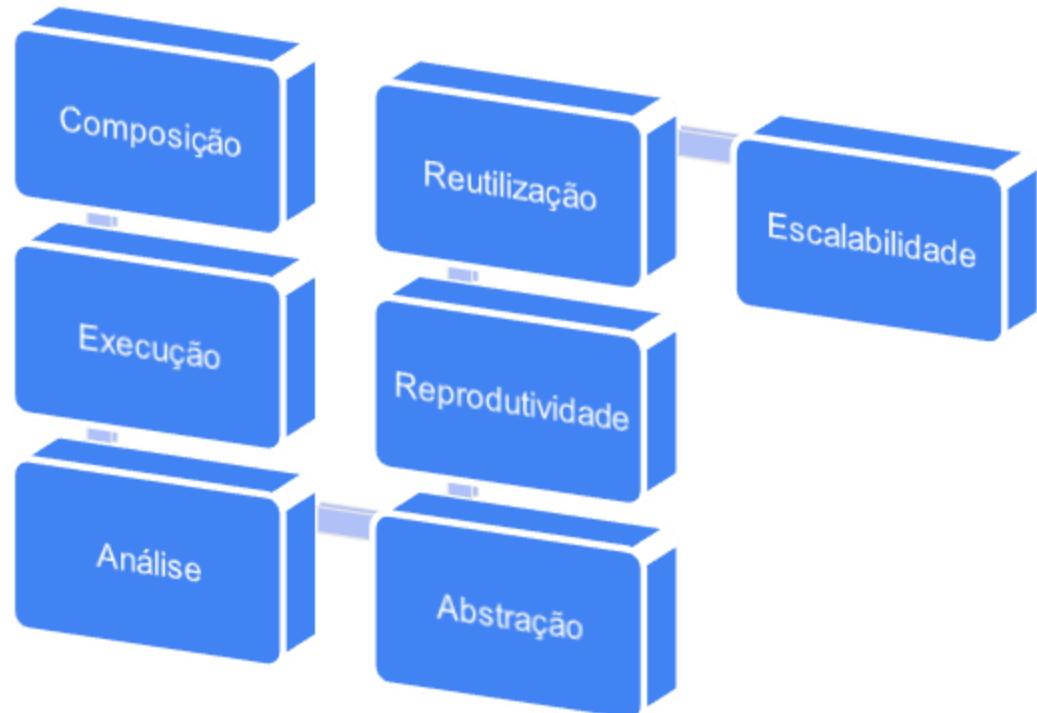
Instrumentos e simulações que geram grande volume de dados



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

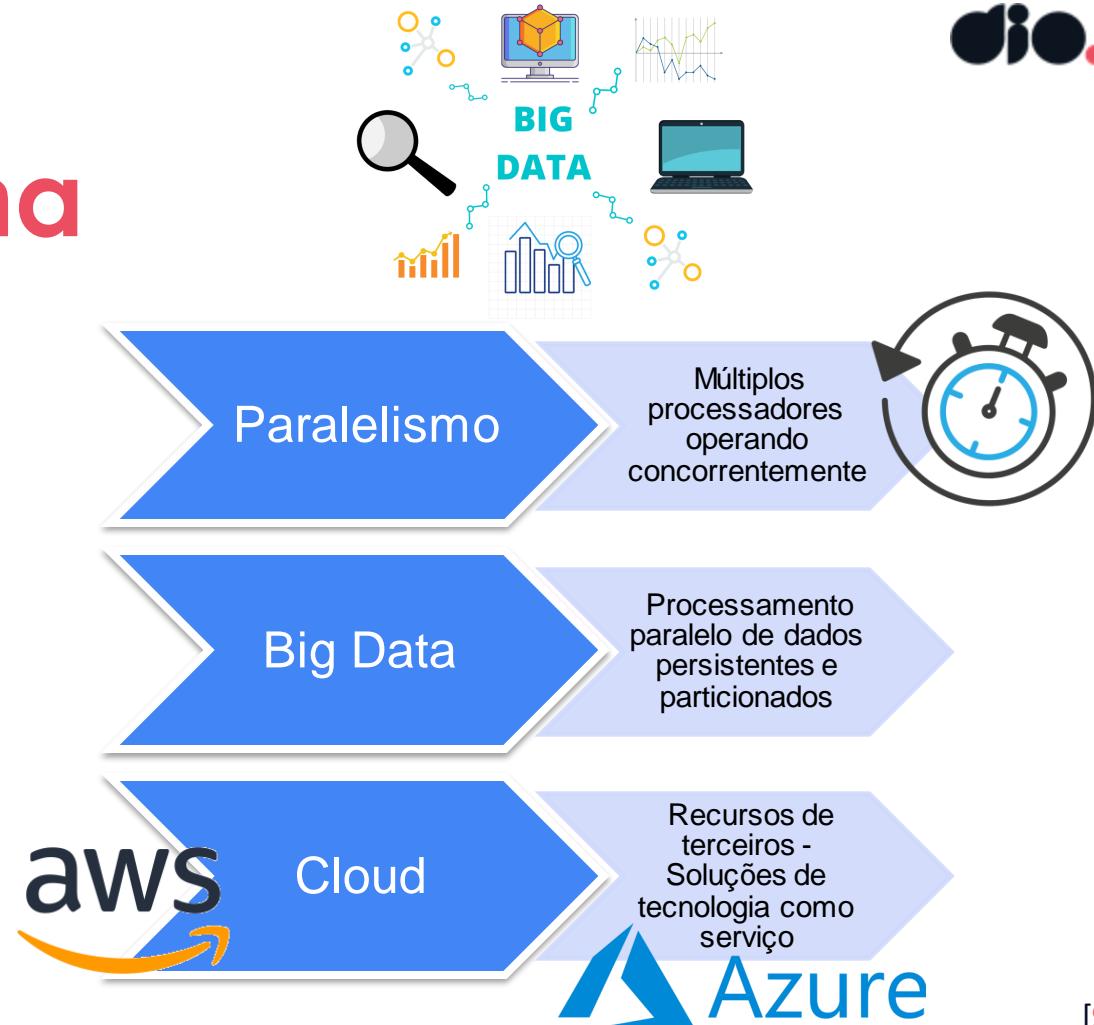
Modelo anterior: empírico, teórico e computacional

# 4º Paradigma

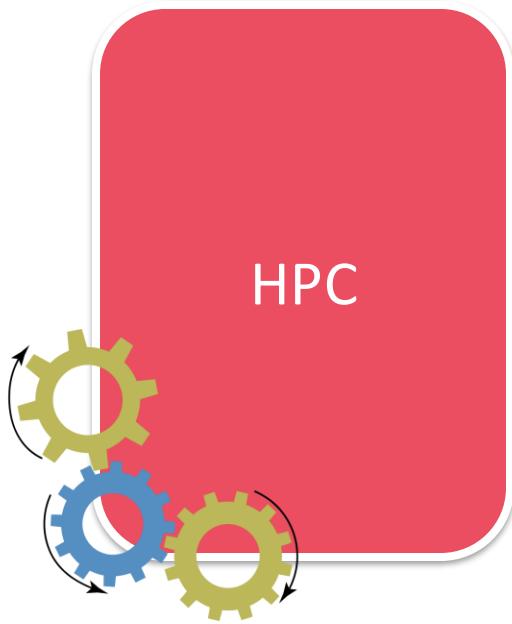


# 4º Paradigma

Experimentos  
realizados em larga  
escala

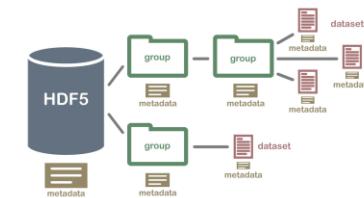


# High Performance Computing



- 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

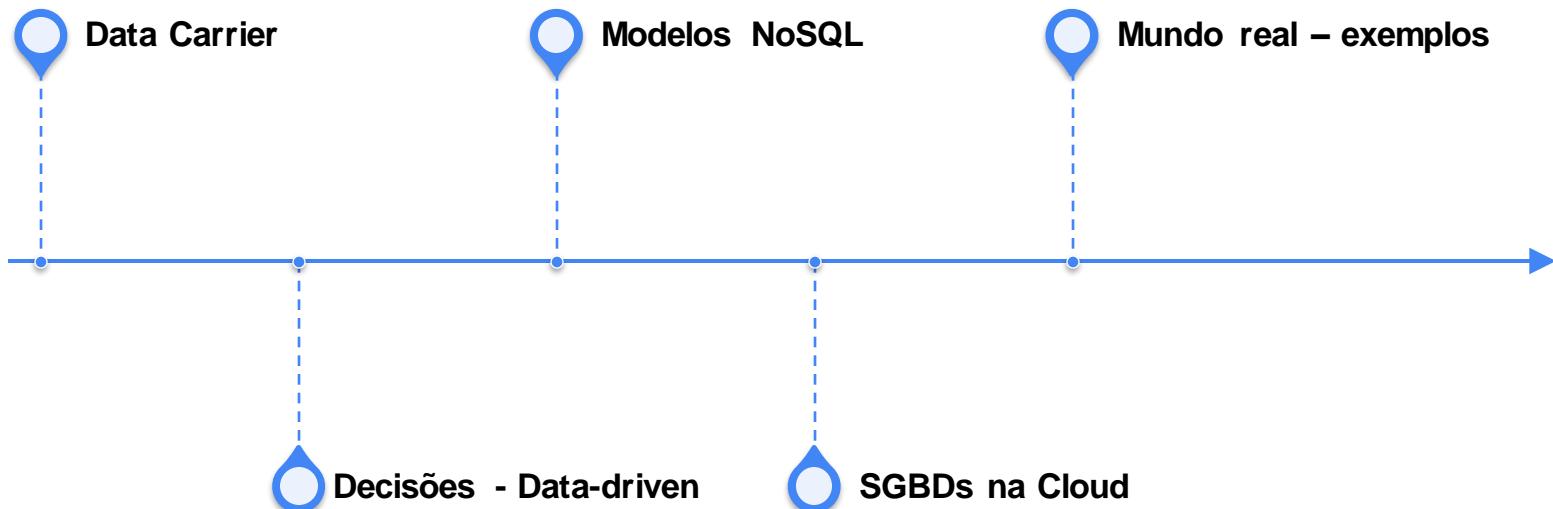


## Etapa 4

# 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

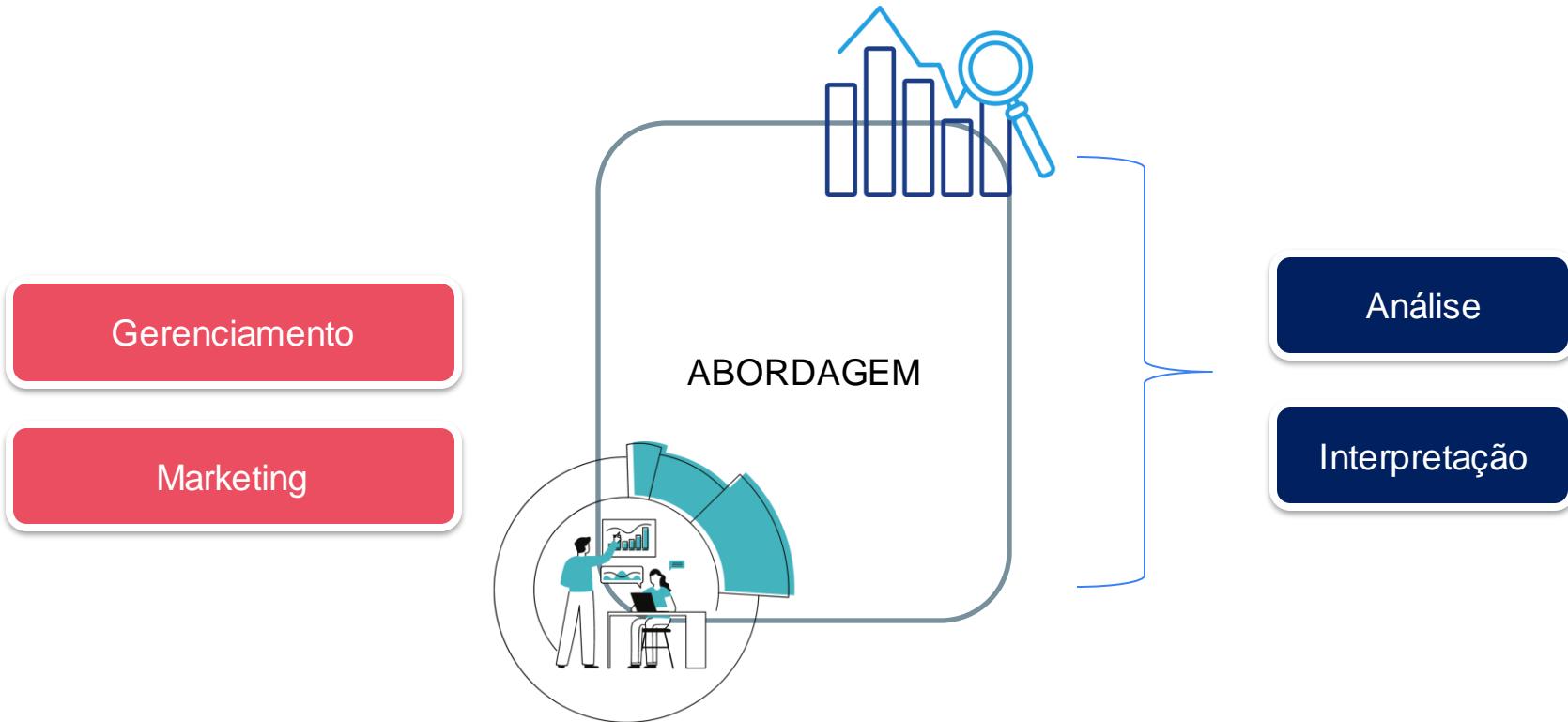


- Criação de dashboards
- Apresentação visual dos dados

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

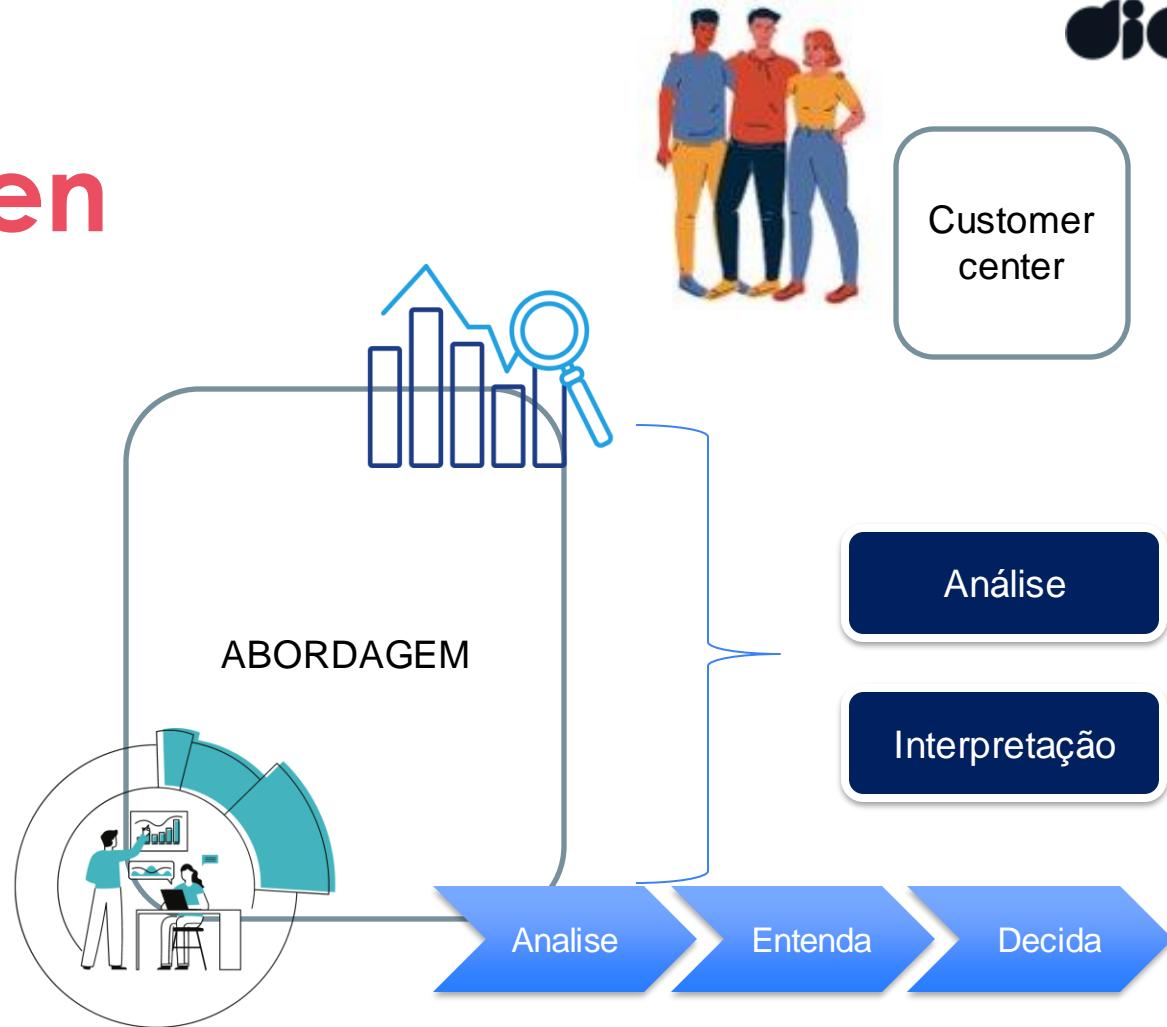
Analista de dados

# Data-driven



# Data-driven

- Área estratégica
- Gerenciamento
- Marketing



# Modelos NoSQL

## SGBDs NoSQL

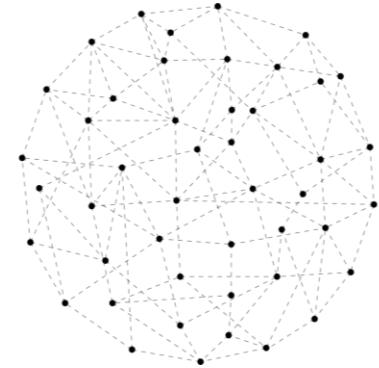
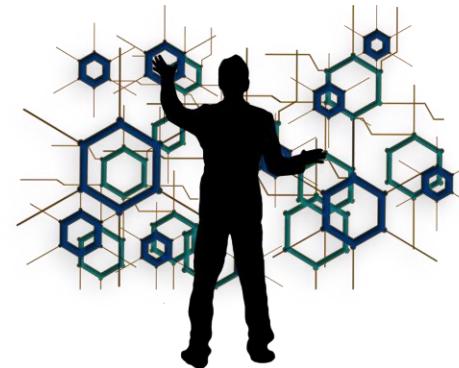
Documentos

Wide-columns

Key-Value

Grafos

Orientado à Objetos



# Modelos NoSQL

## SGBDs NoSQL

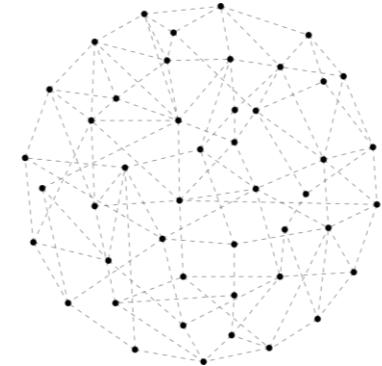
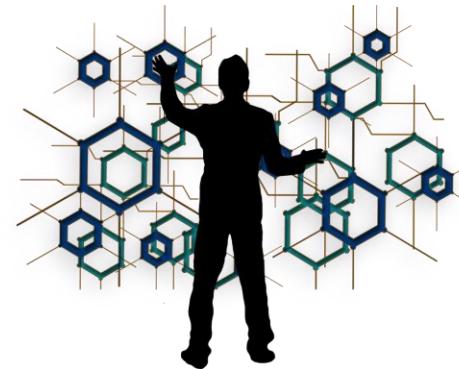
Documentos

Wide-columns

Key-Value

Grafos

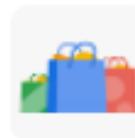
Orientado à Objetos



Black Friday

Friday, November 25, 2022

...



# Modelos NoSQL

## SGBDs NoSQL

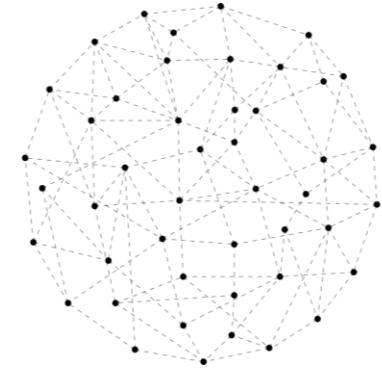
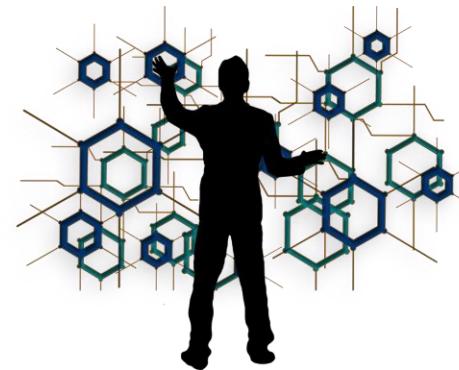
Documentos

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



**ORACLE**  
DATABASE

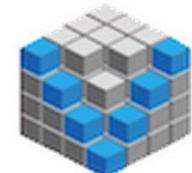
**NETFLIX**   
**MySQL**



**ORACLE**  
DATABASE



DB  
DB.io  
Database of  
Databases

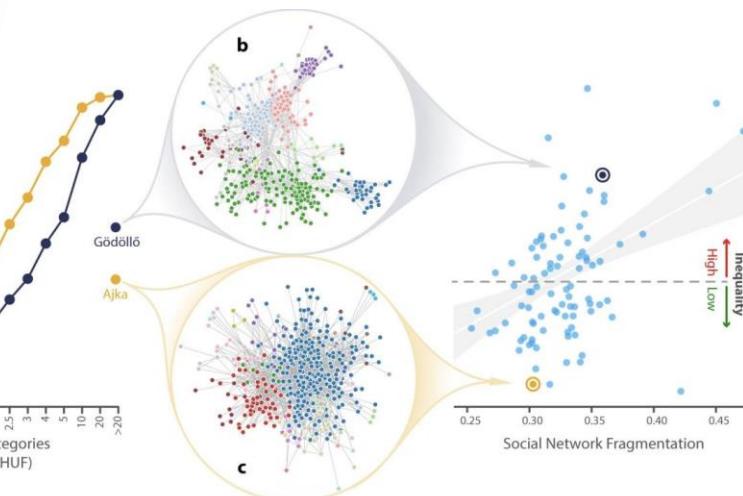
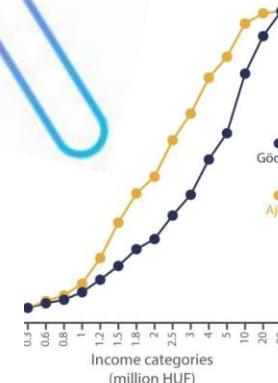


# Mundo Real



## Black Friday

Friday, November 25, 2022

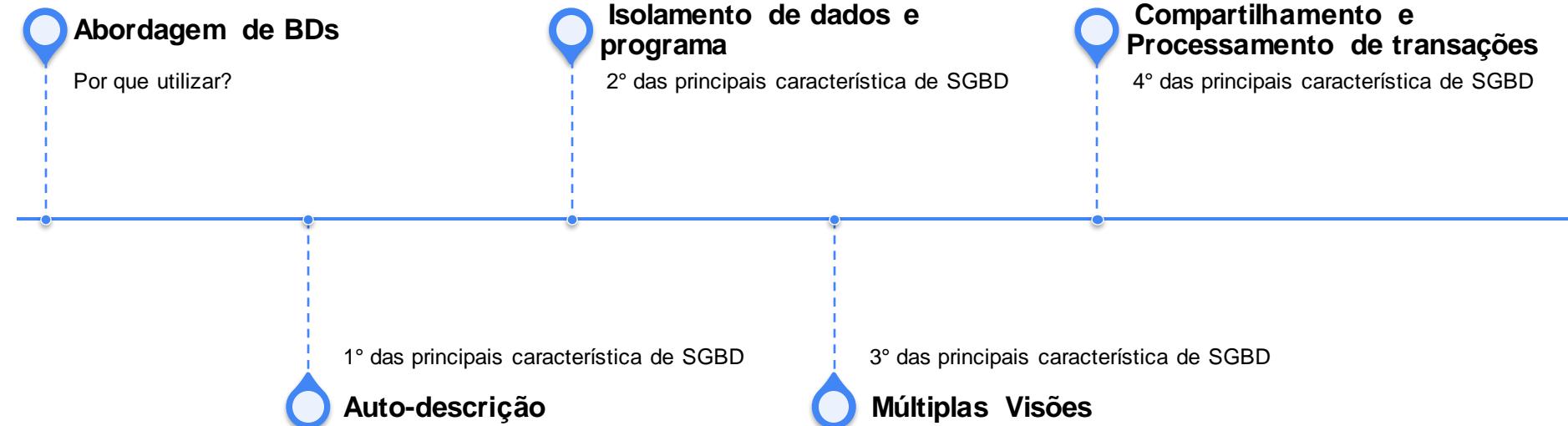


## Etapa 5

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

// Introdução à Banco e dados

# Conversa



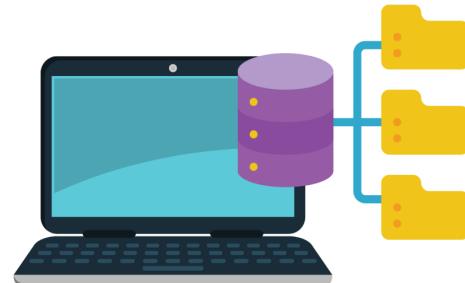
# Abordagem de BD



# Abordagem de BD



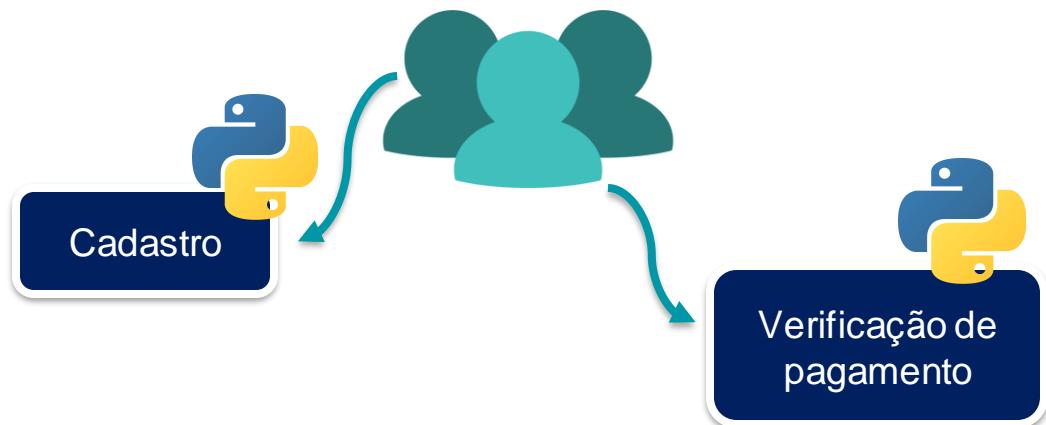
Abordagem tradicional



Abordagem BDs

# Abordagem de BD

Suponha as aplicações



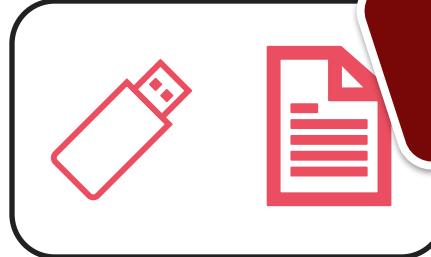
# Abordagem de BD

Suponha as aplicações

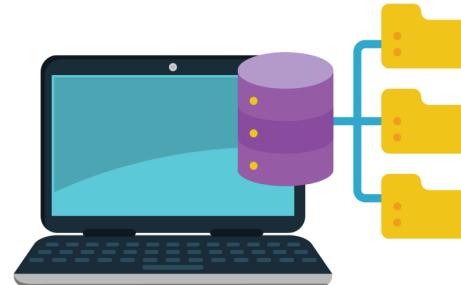
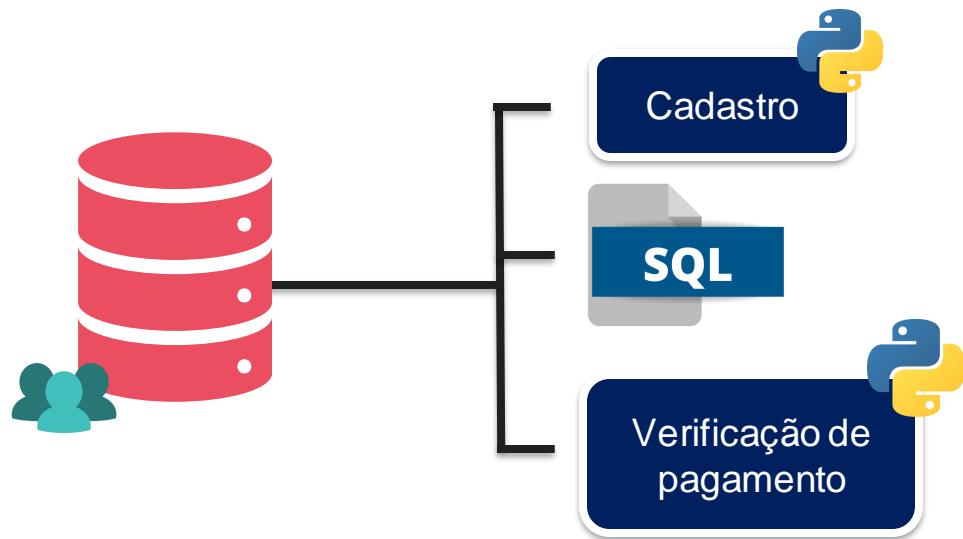


# Abordagem de BD

Suponha as aplicações:



# Abordagem de BD



Abordagem BDs

# Abordagem de BD

Características principais:

Abstração

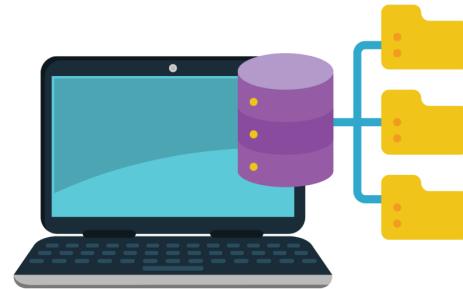
Auto-descrição

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



# Natureza Auto-descritiva



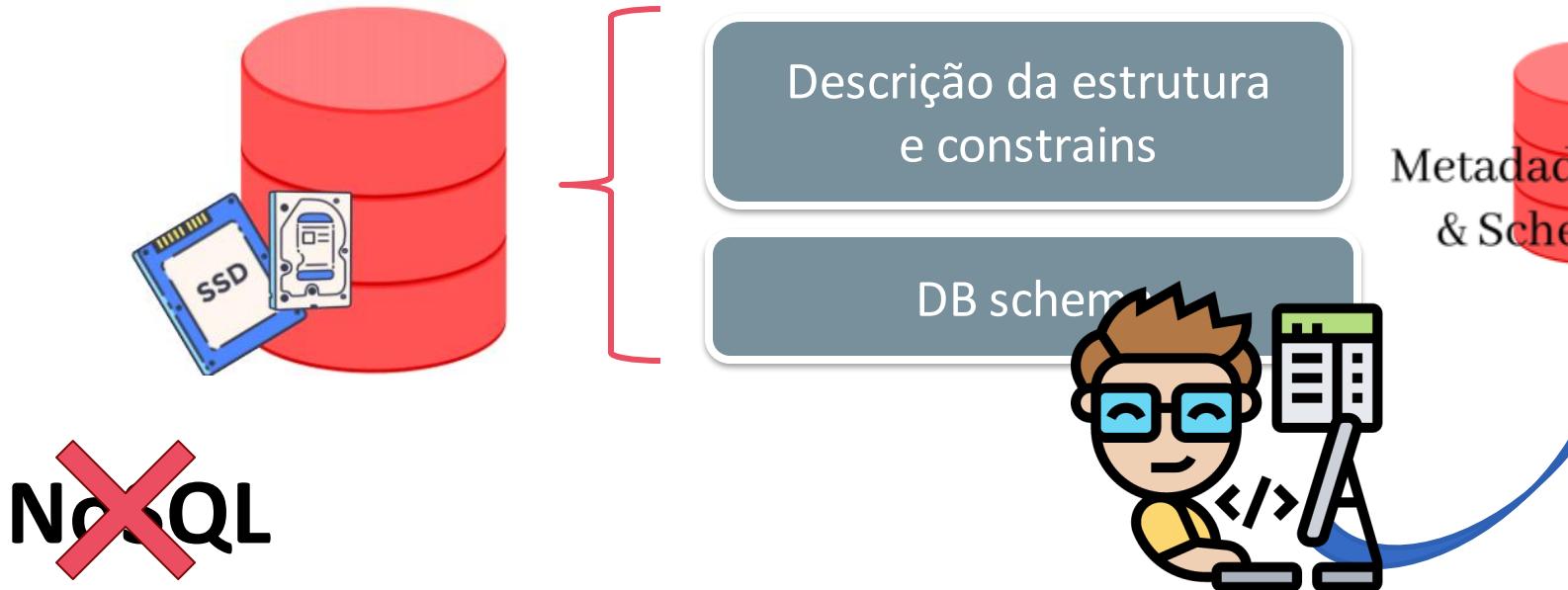
Descrição da estrutura  
e constraints

DB schema



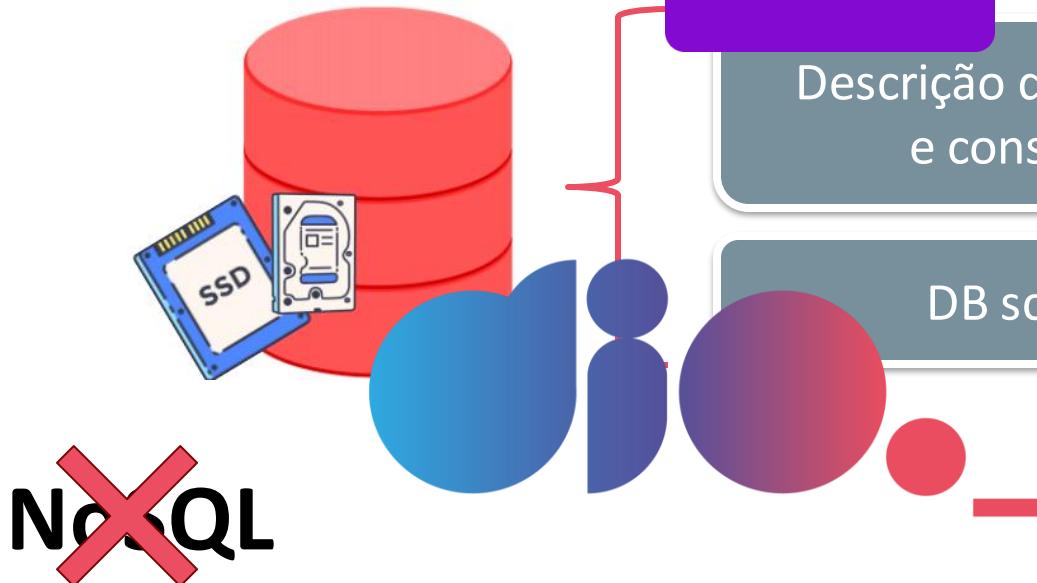
NoSQL

# Natureza Auto-descritiva



# Natureza Autônoma e Criativa

amazon.com.br



NoSQL

Metadados  
& Schema

# Natureza Auto-descritiva



Abordagem tradicional



Programa da Aplicação

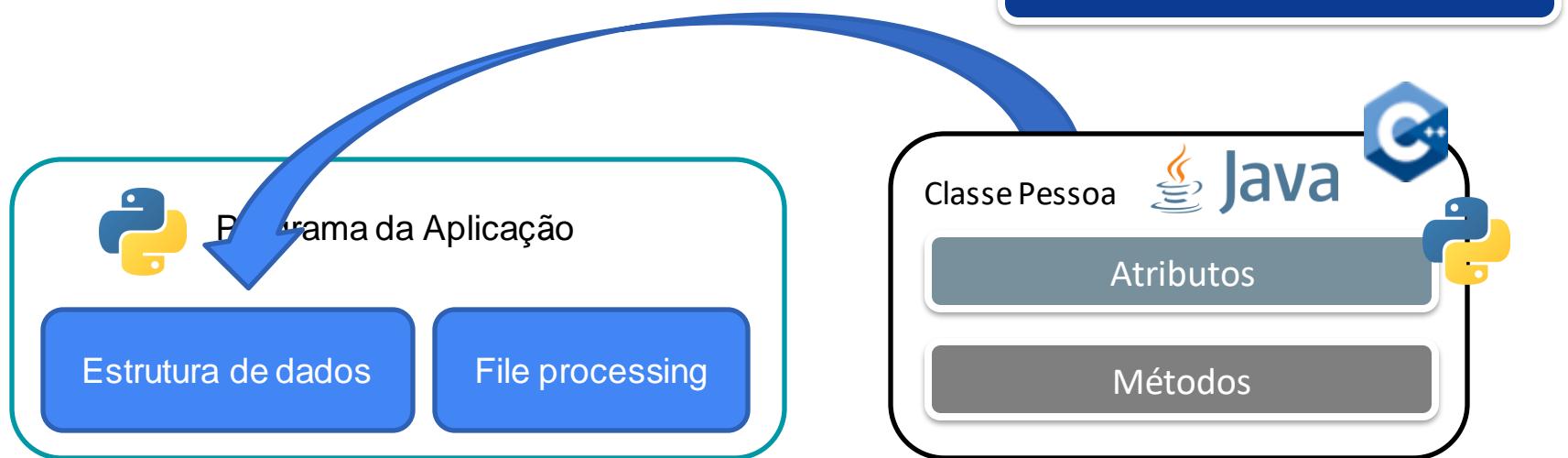
Estrutura de dados

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

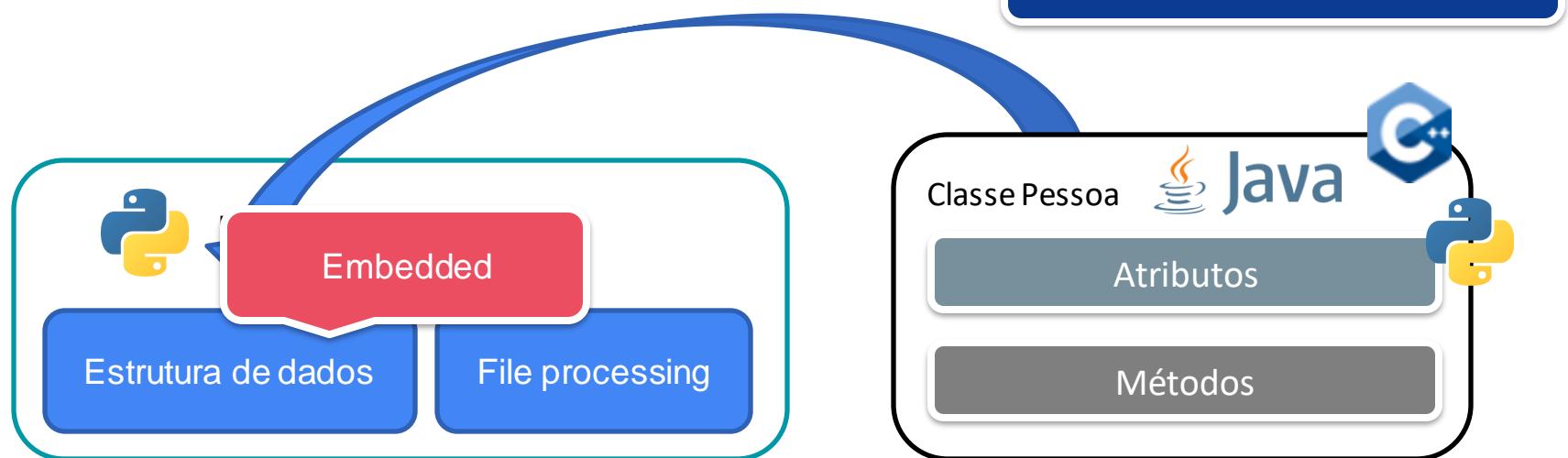
## COLUMNS

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



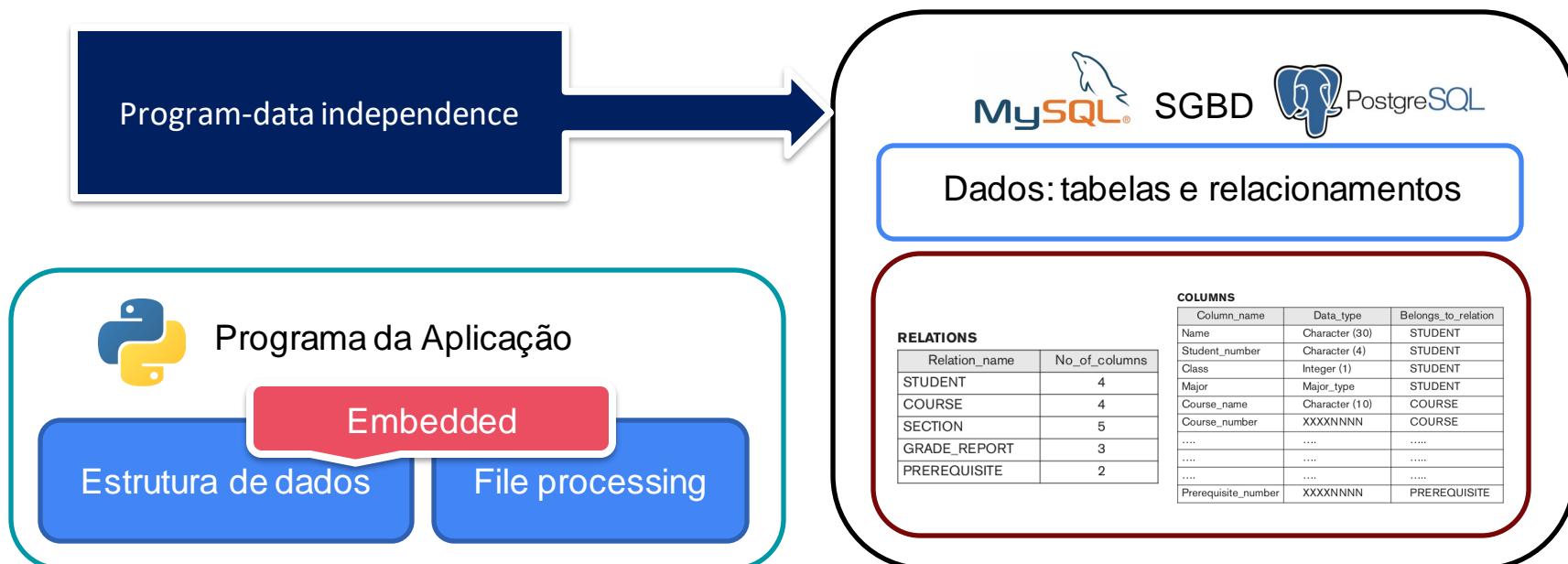
# Isolamento e abstração



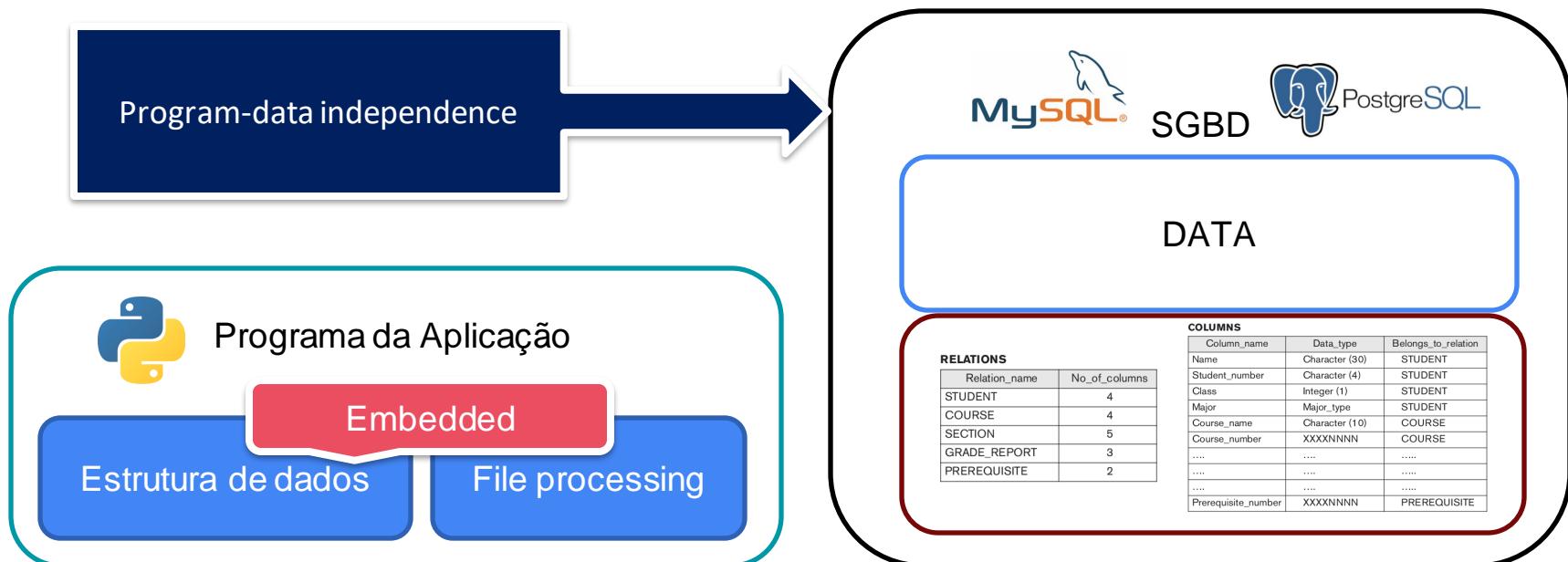
# Isolamento e abstração



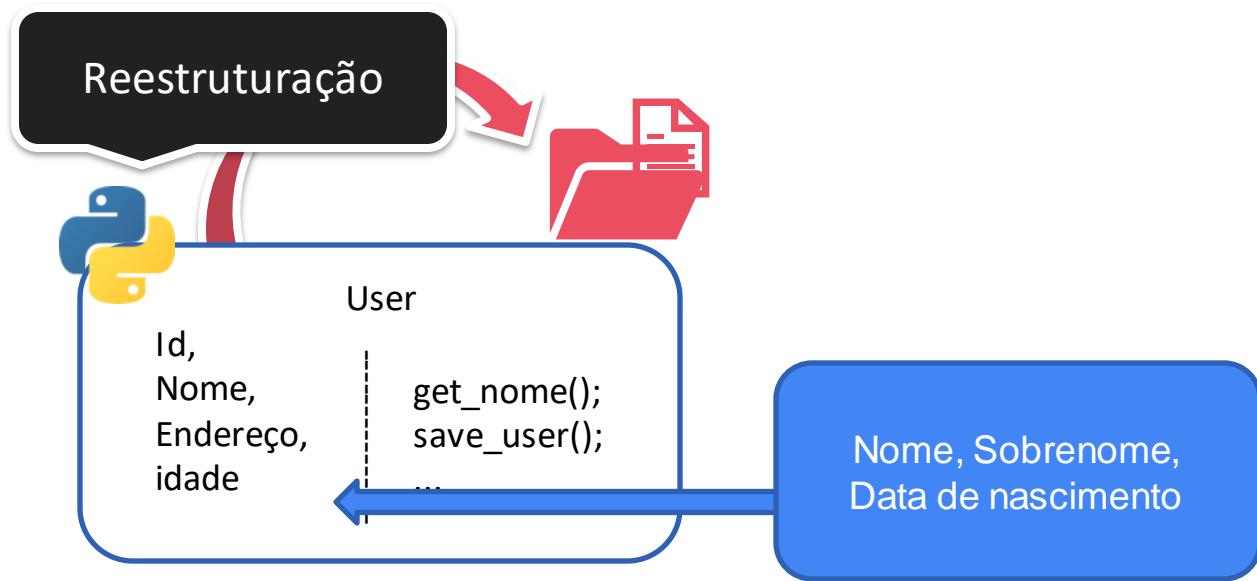
# Isolamento e abstração



# 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

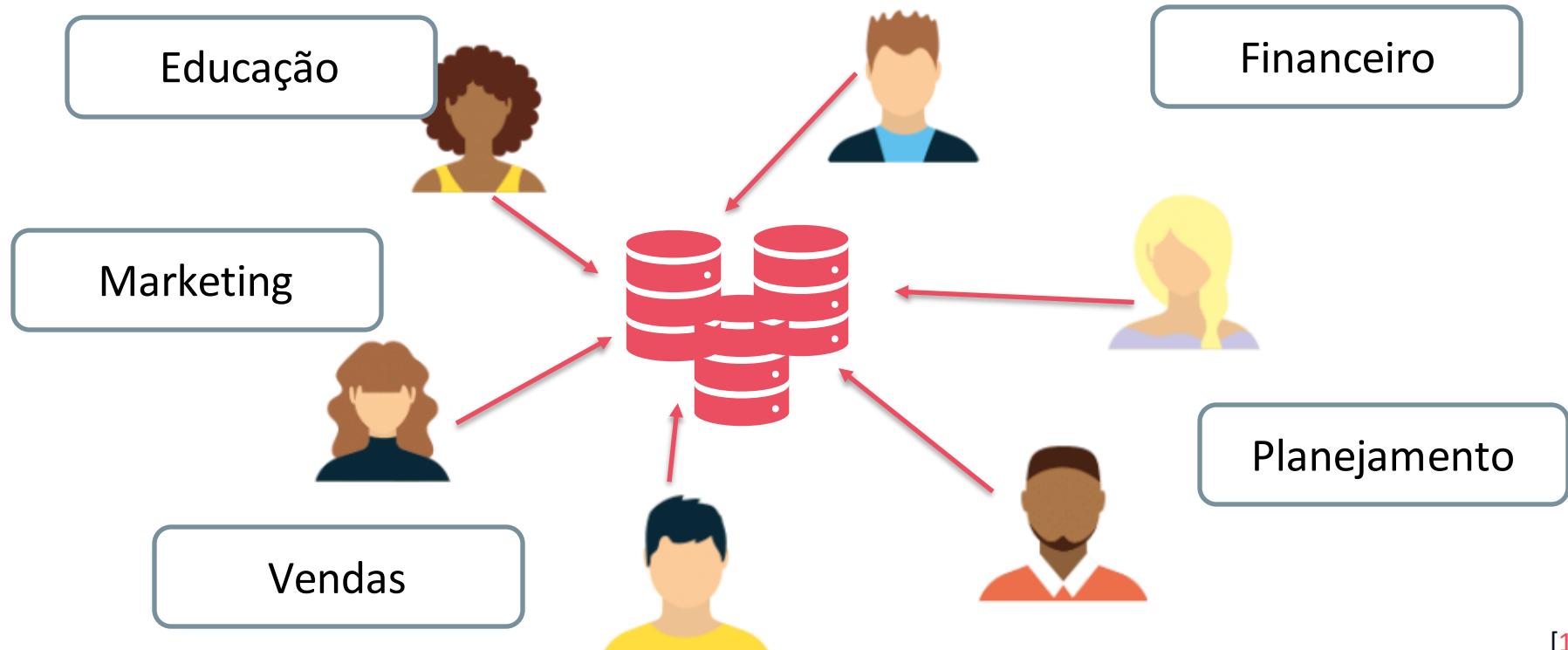


Catálogo

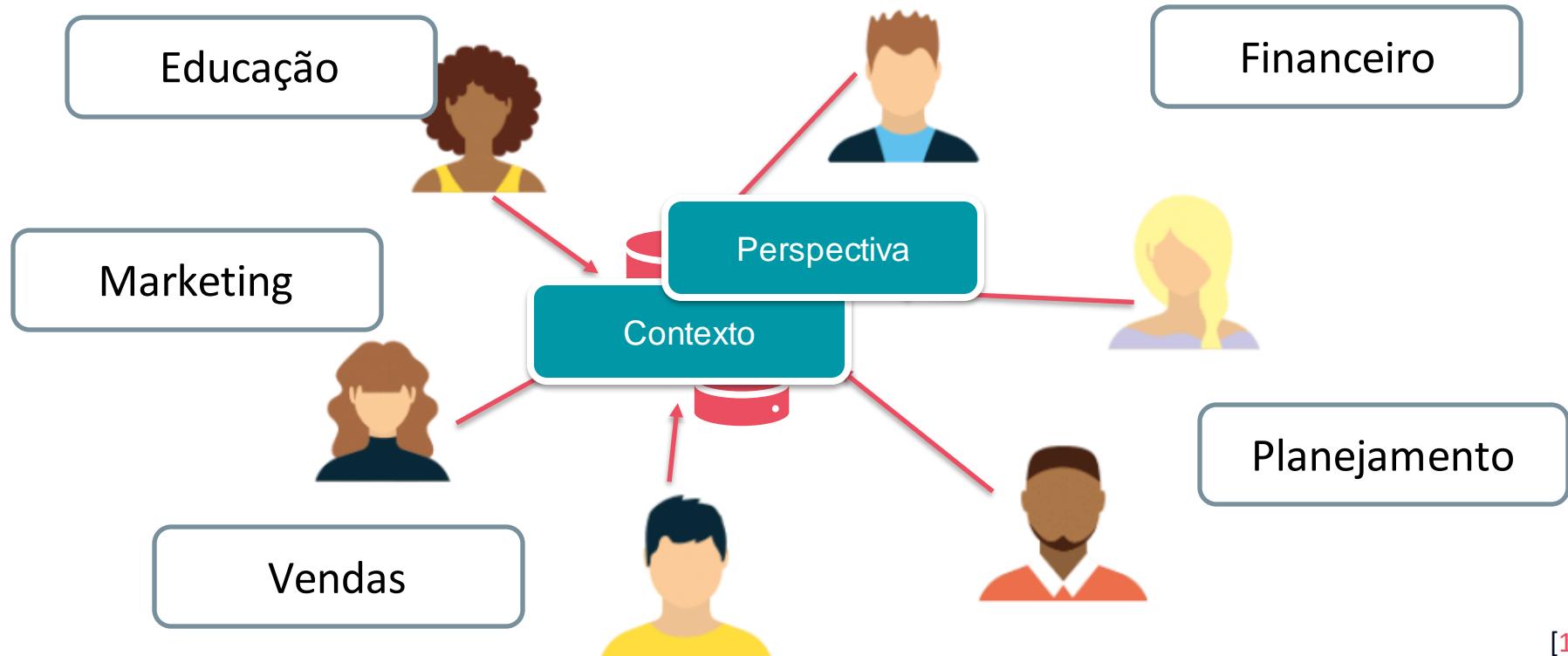
# Suporte a Múltiplas Visões dos dados



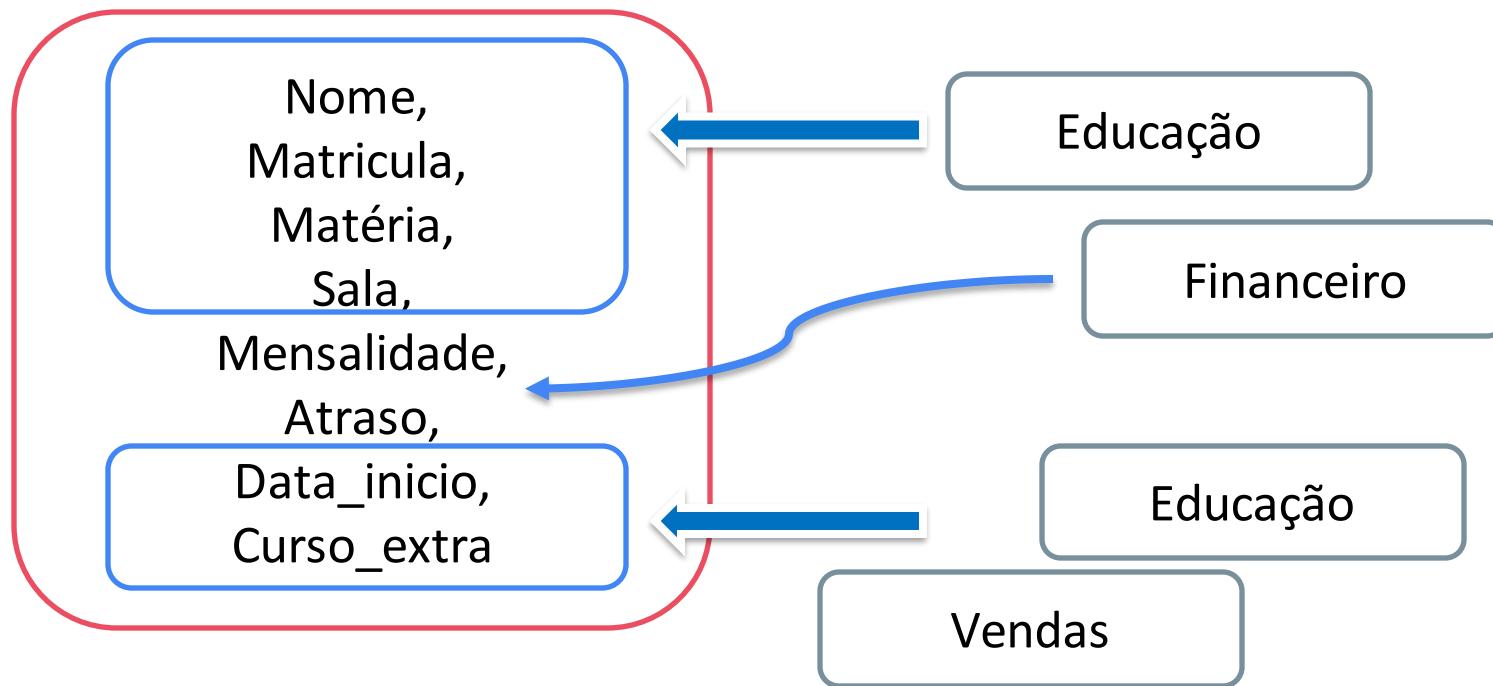
# Table Views



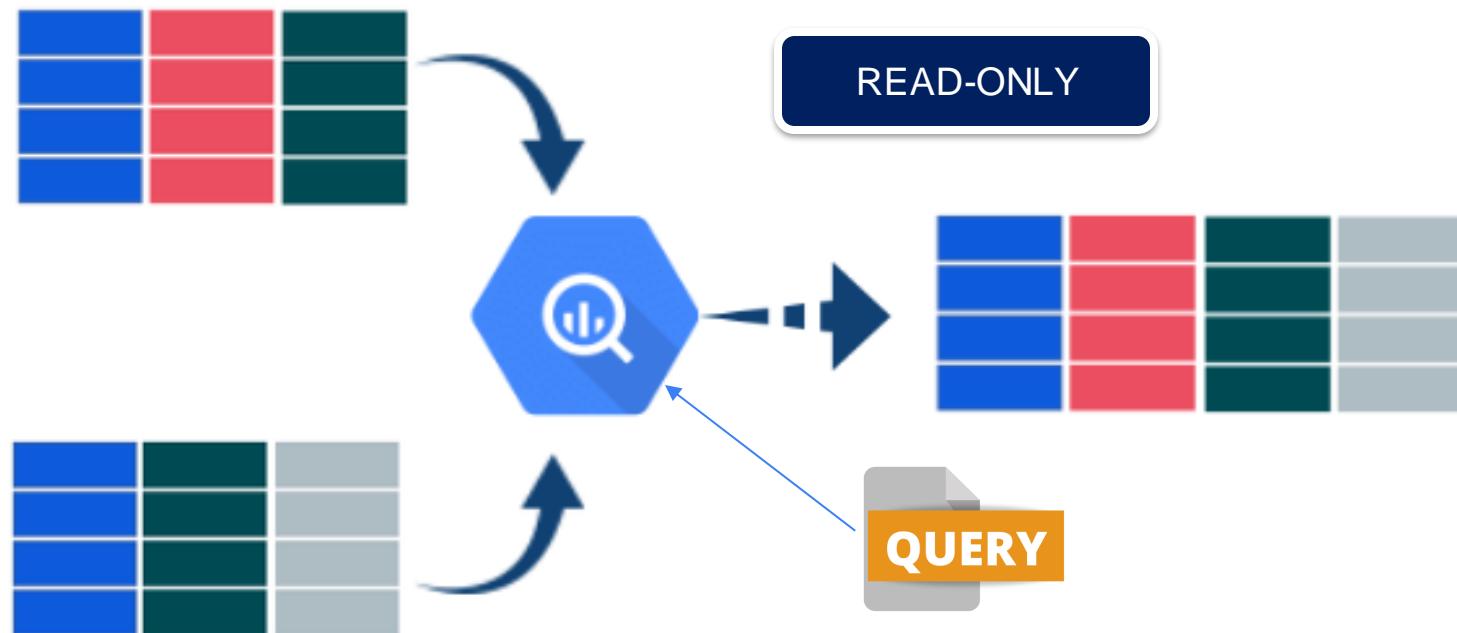
# Table Views



# Table Views



# Table Views



# Table Views

**PREREQUISITE**

Course_number	Prerequisite_number
CS3380	CS3320
CS3380	MATH2410
CS3320	CS1310

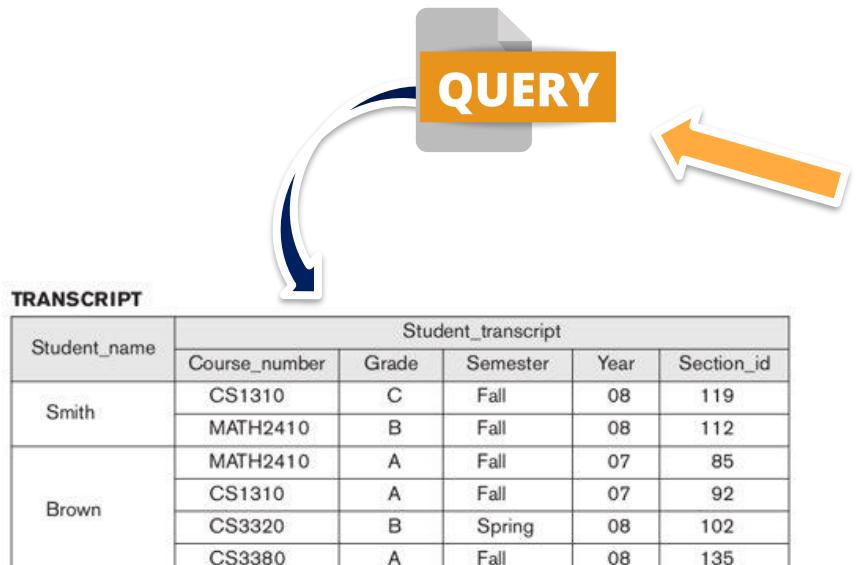
**COURSE**

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

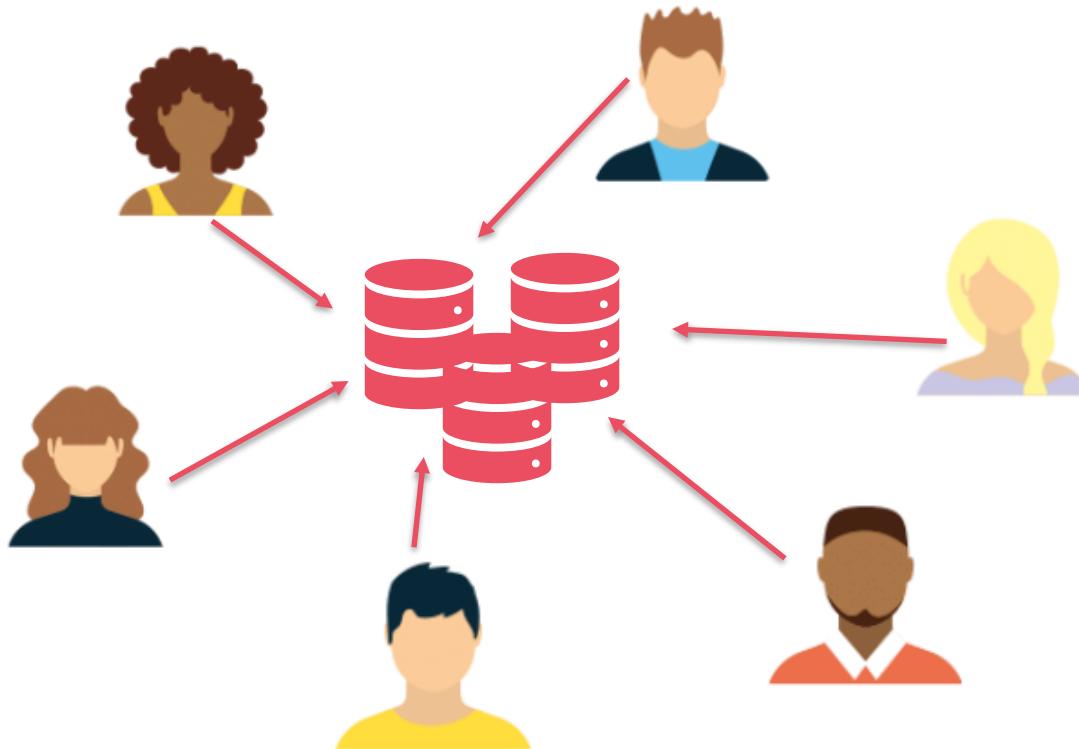
## SECTION

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

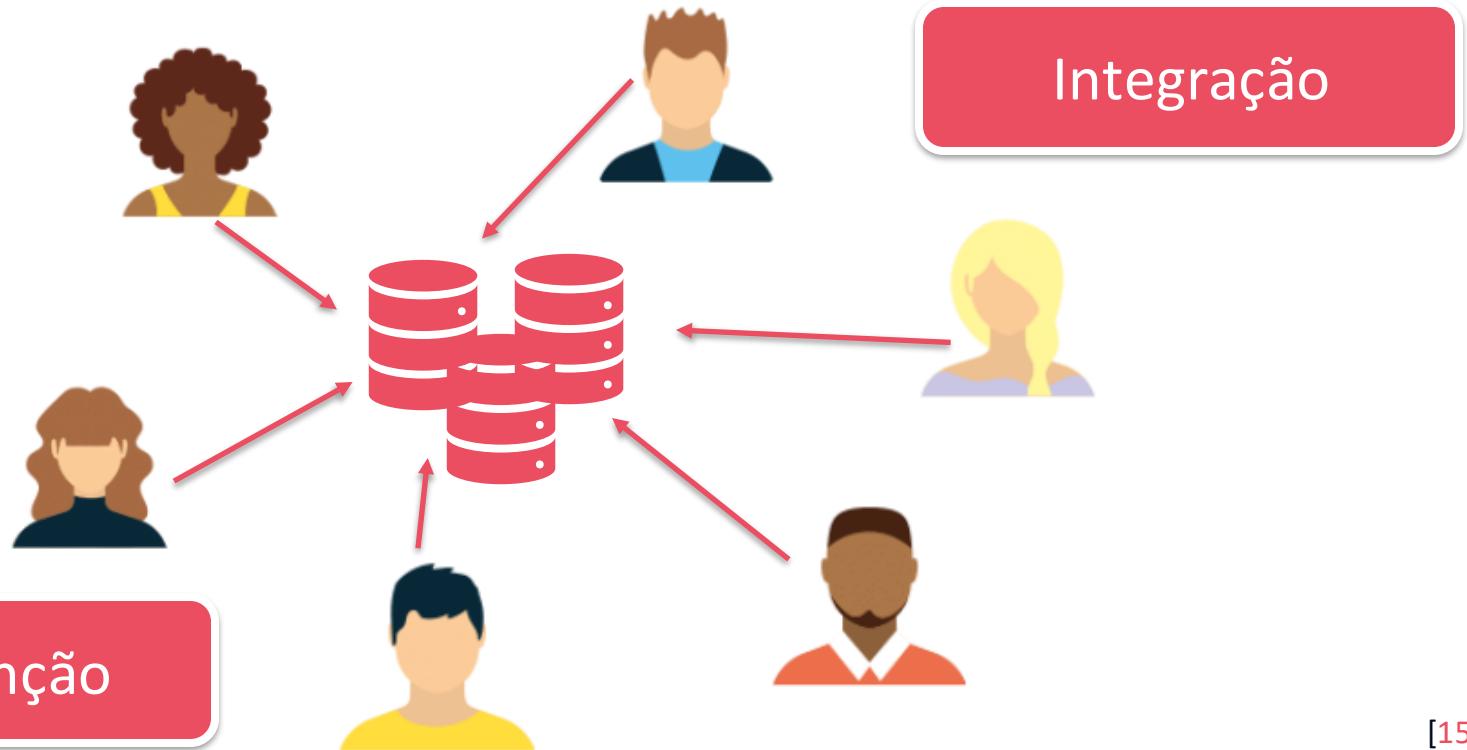
# Compartilhamento de dados e processamento de transações multiusuários



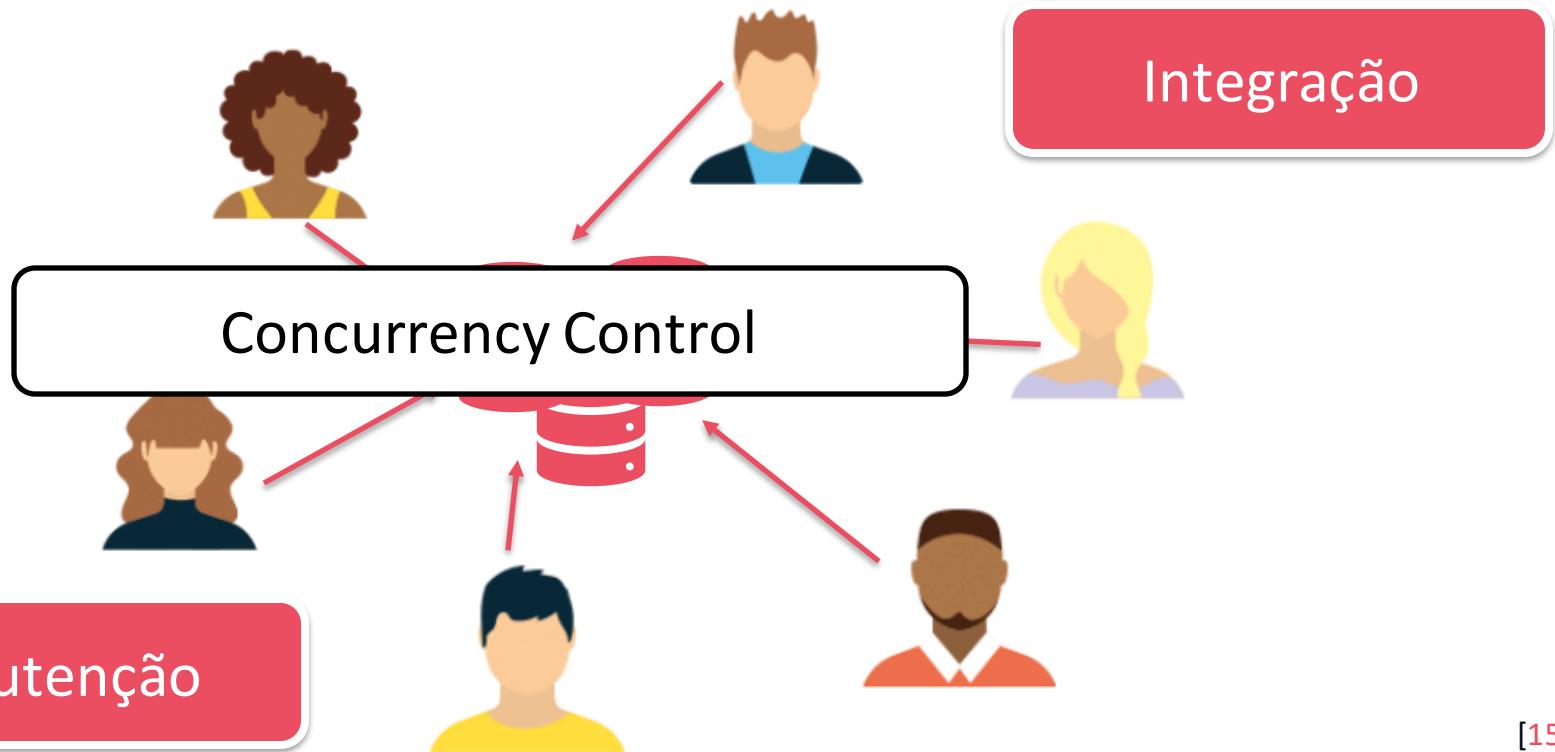
# Design – Múltiplos acessos



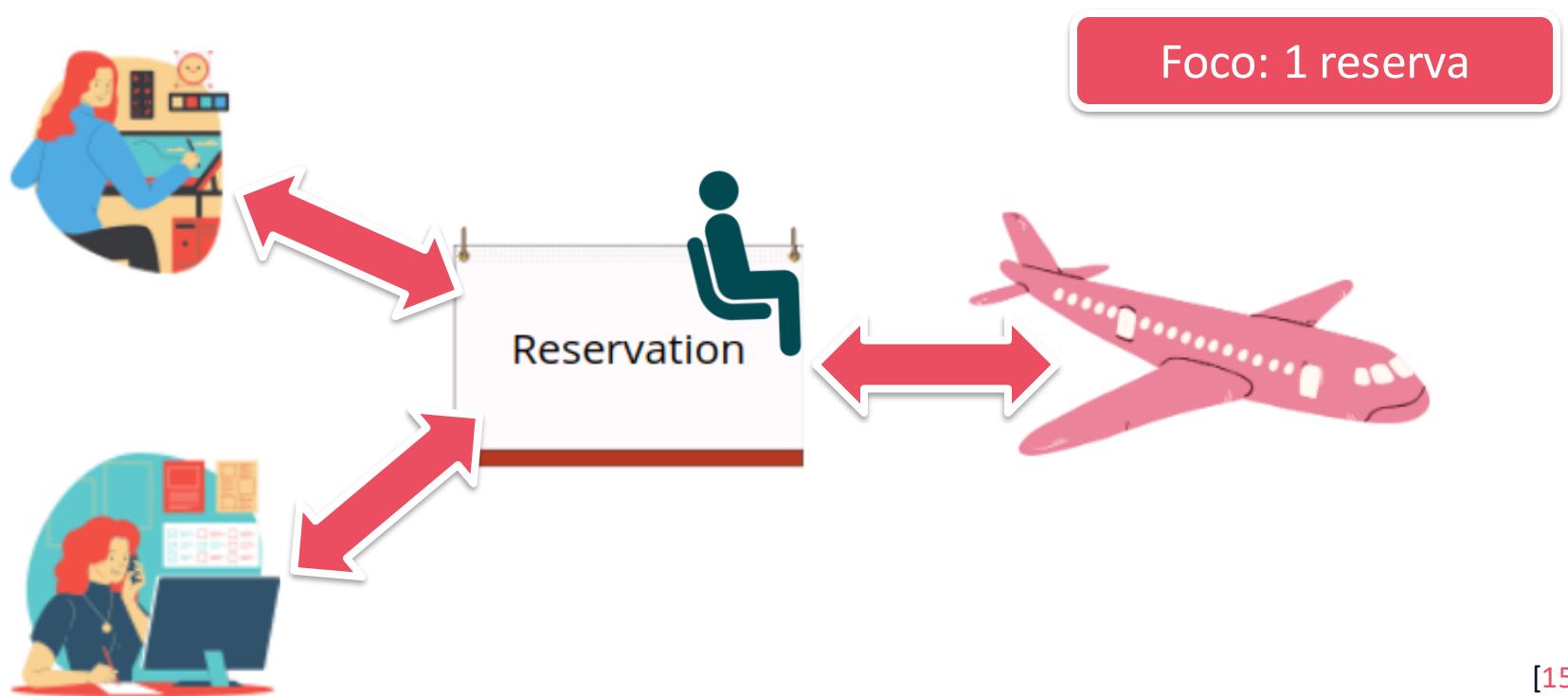
# Design – Múltiplos acessos



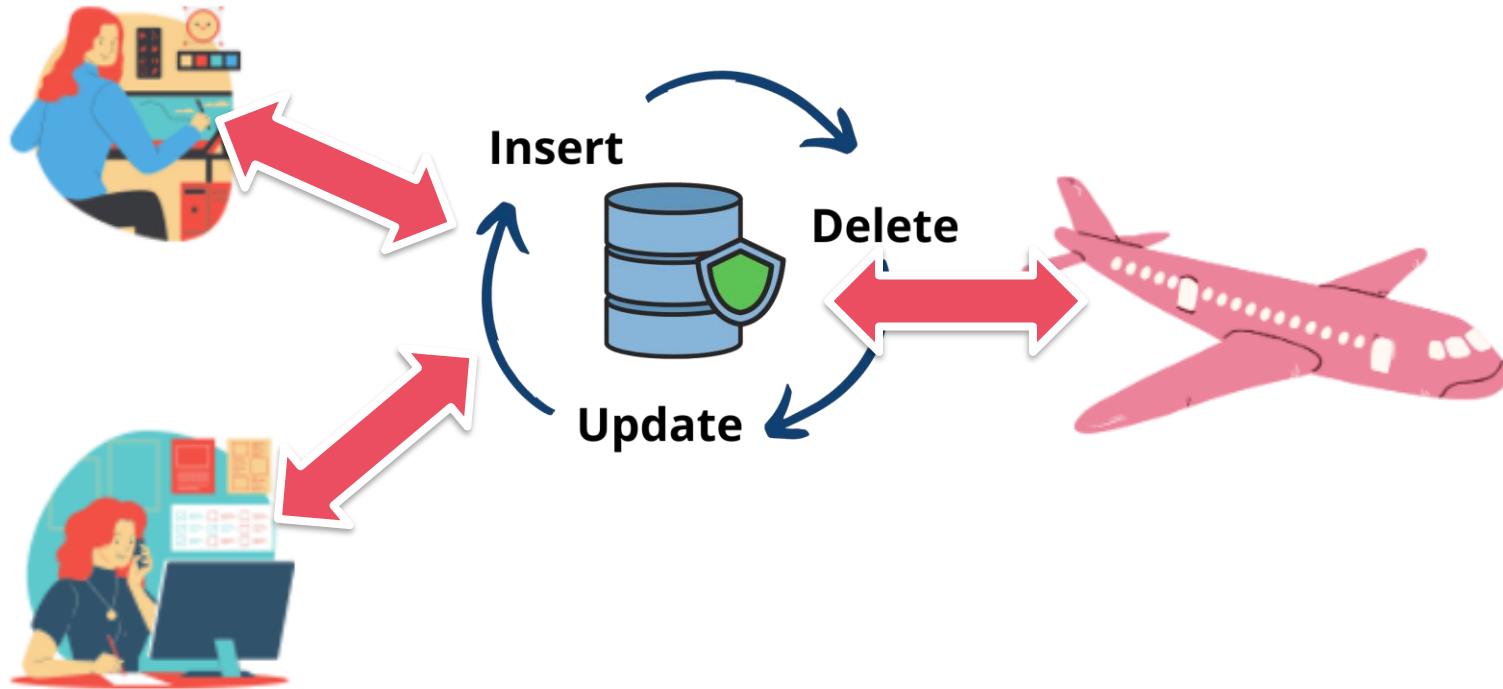
# Concorrência



# Múltiplos acessos



# OLTP



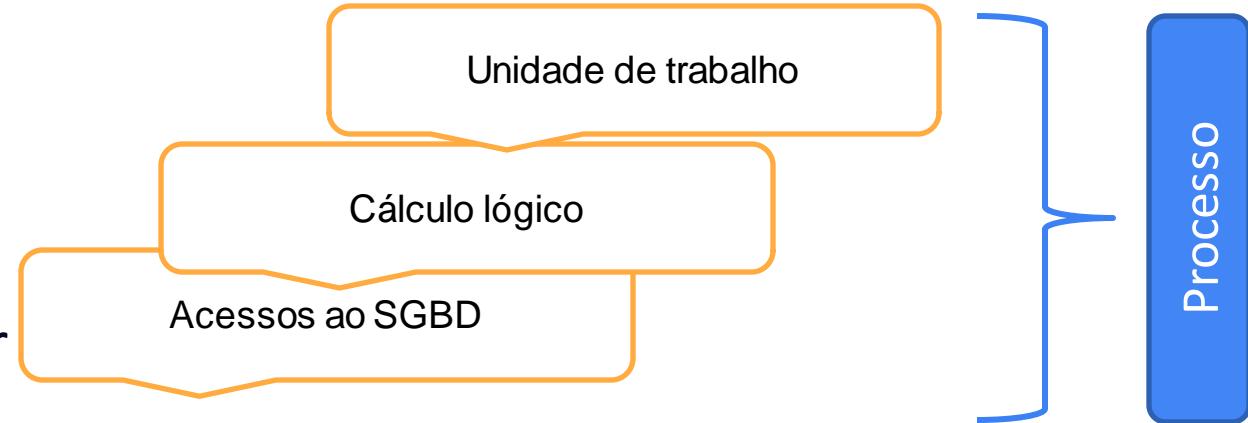
# OLTP

- App multiuser
- Gerenciador: transações concorrentes

Online Transaction Processing

# OLTP

- App multiuser
- Gerenciador: transações concorrentes



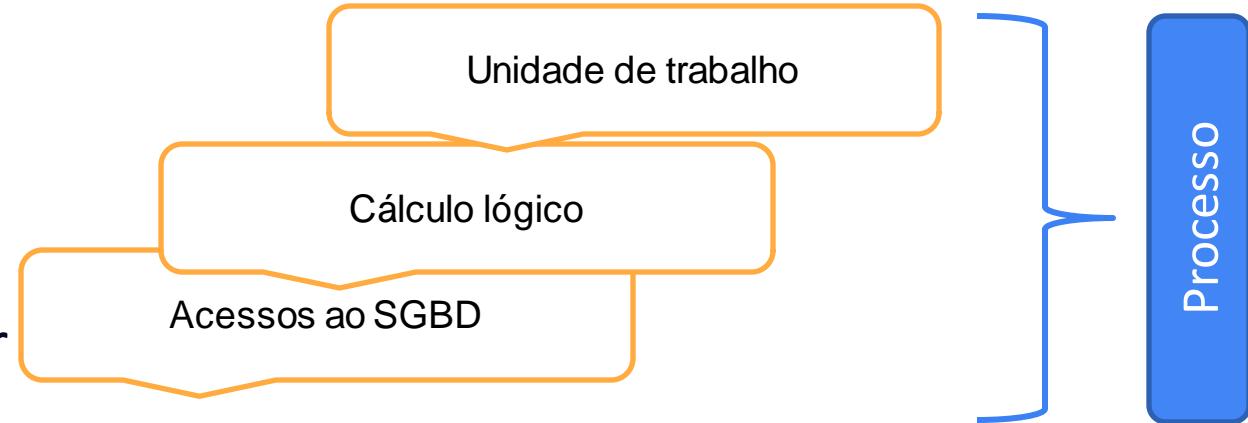
Execução sem interferência

Isolamento

Online Transaction Processing

# OLTP

- App multiuser
- Gerenciador: transações concorrentes



Execução sem interferência

Atomicidade

**8 ou 80!**

Online Transaction Processing

# OLTP



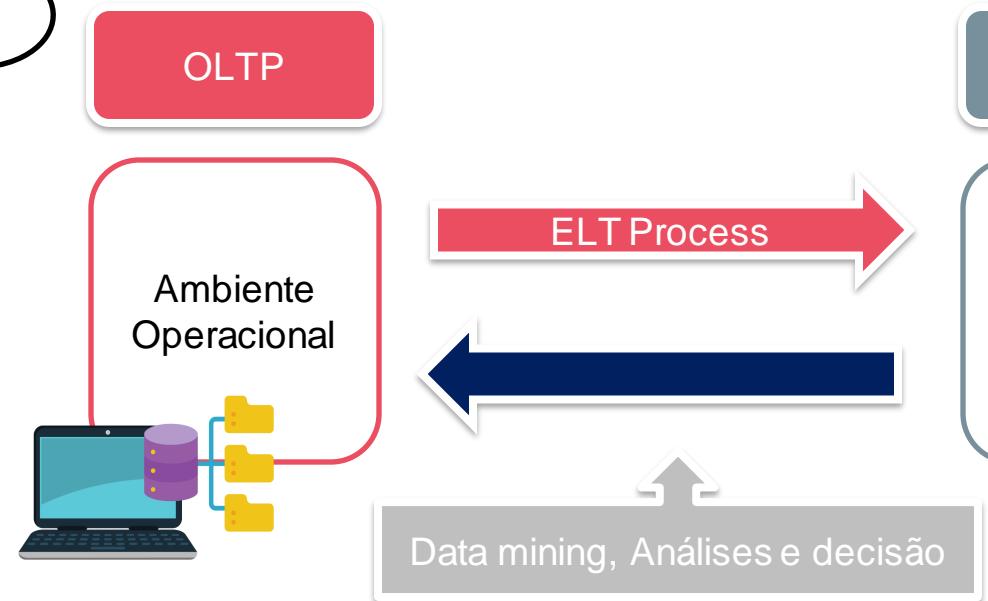
Operacional

Processamento de dados

Processamento de dados

Transaction-driven

# OLTP

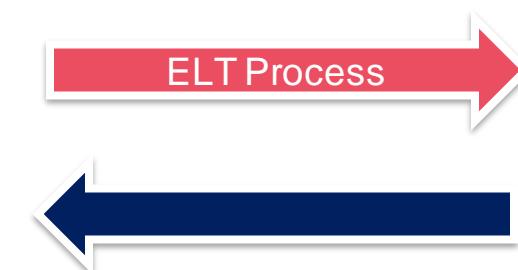


Data mining, Análises e decisão

# OLTP



ELT Process

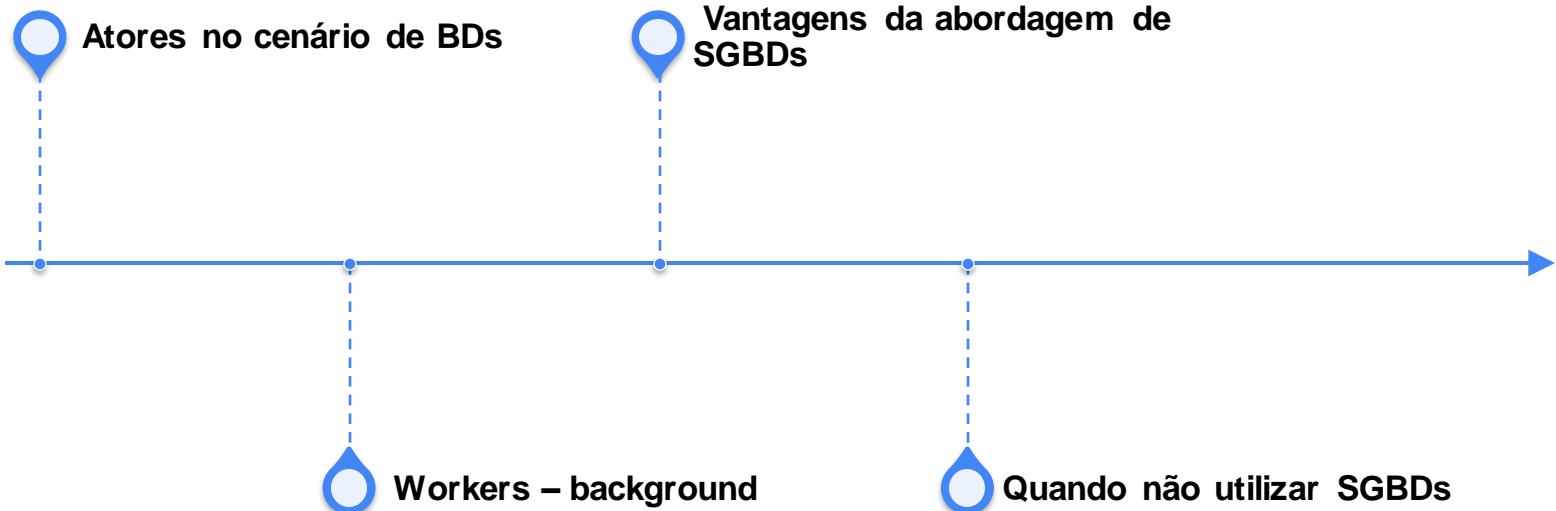


## Etapa 6

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

// Introdução à Banco de dados

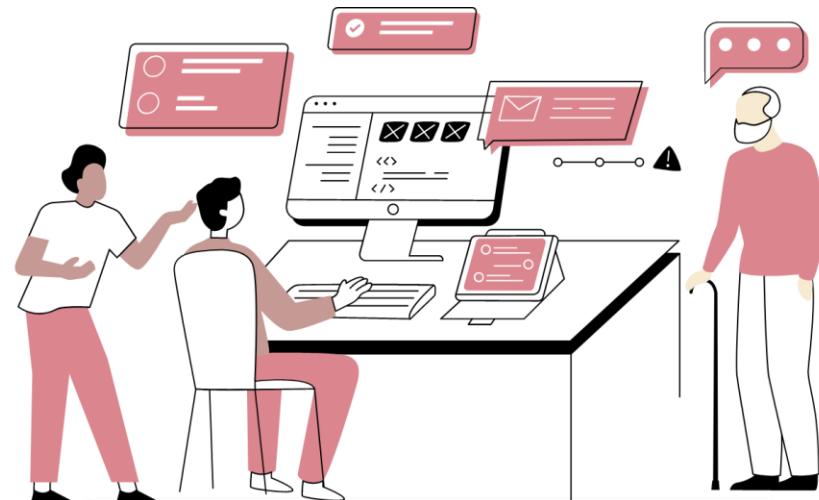
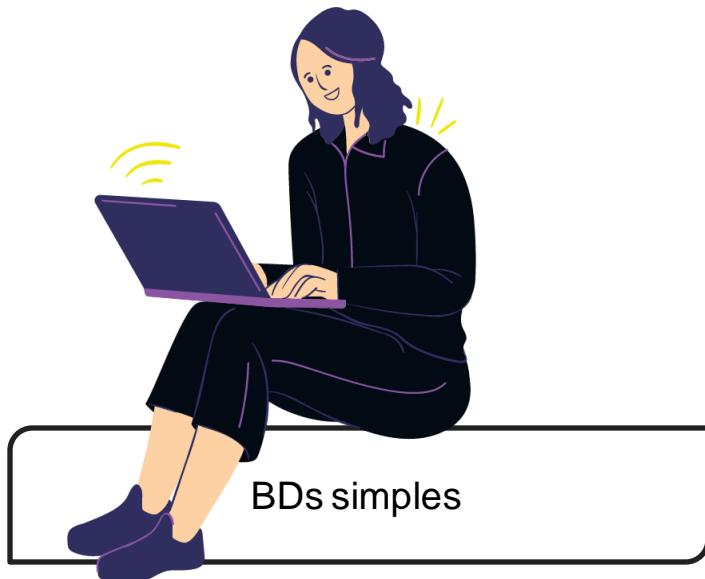
# Conversa



# Quais são os atores em Banco de Dados?

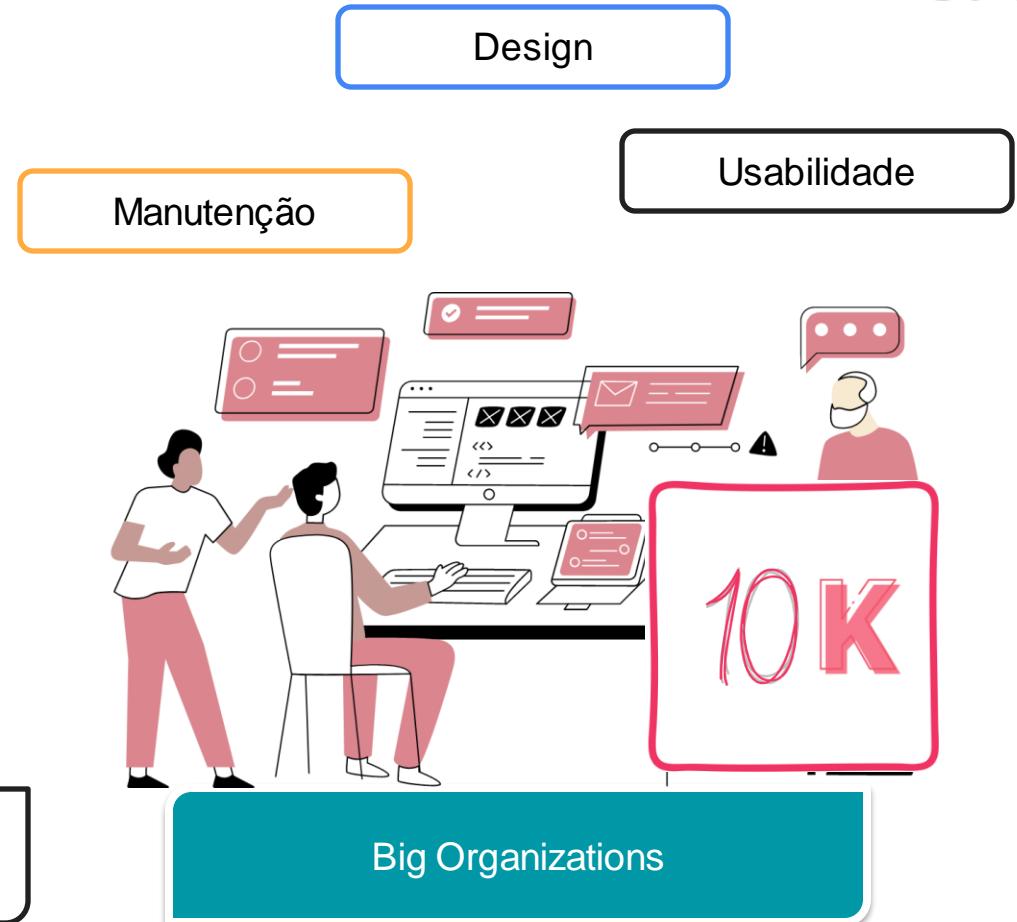
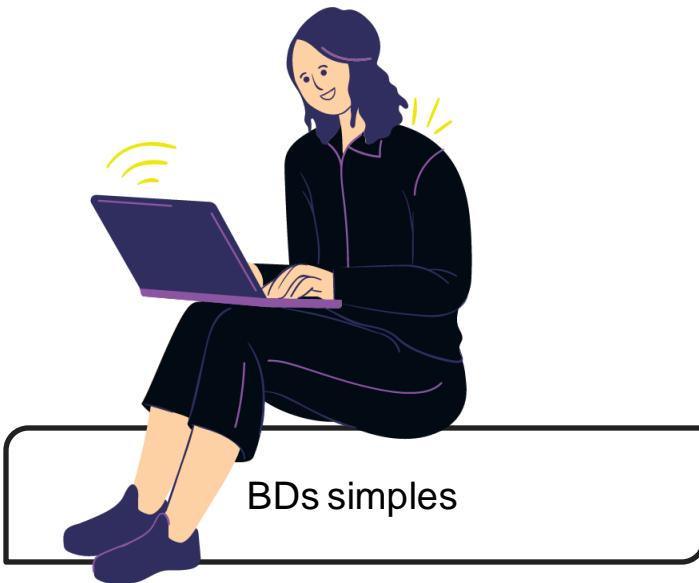


# Atores



Big Organizations

# Atores



# Atores



Administrador

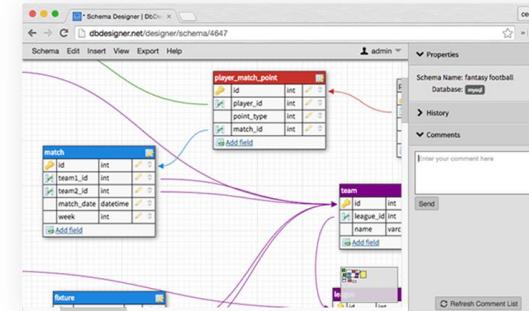
Designers

- Dia-a-dia
- Diretamente ligados ao contexto

Usuários finais



# Atores - Designer

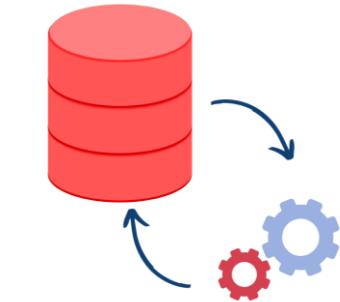


- Identificar dados e requisitos
- Representação e Estrutura
- Fase preliminar

Modelagem



# Atores - Administrador



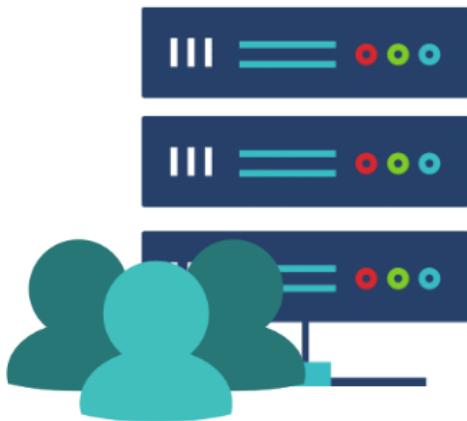
- Gerencia Recursos
- Orquestração
- Autorização de acesso



DBA Staff



# 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

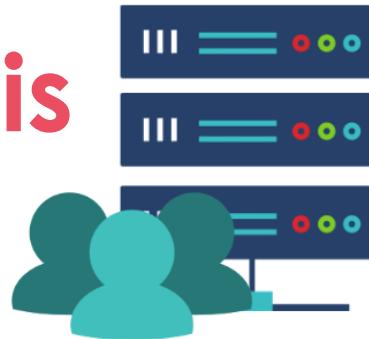
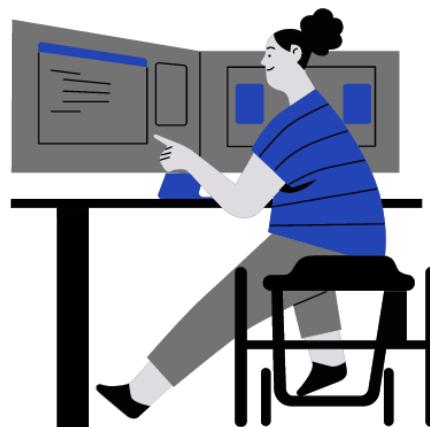


Propósito do SGBD

# Atores - Usuários Finais

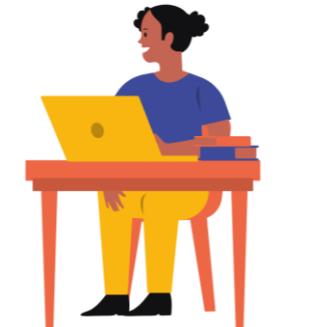
- Casuais
- Ingênuos
- Sofisticados
- **Standalone**

BD pessoal



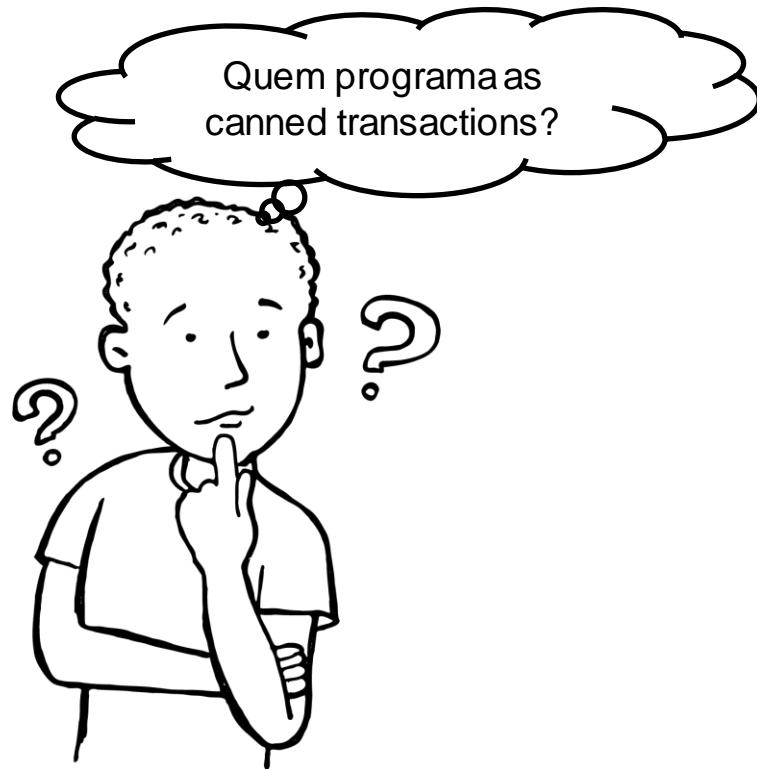
Propósito do SGBD

# Atores - Usuários Finais

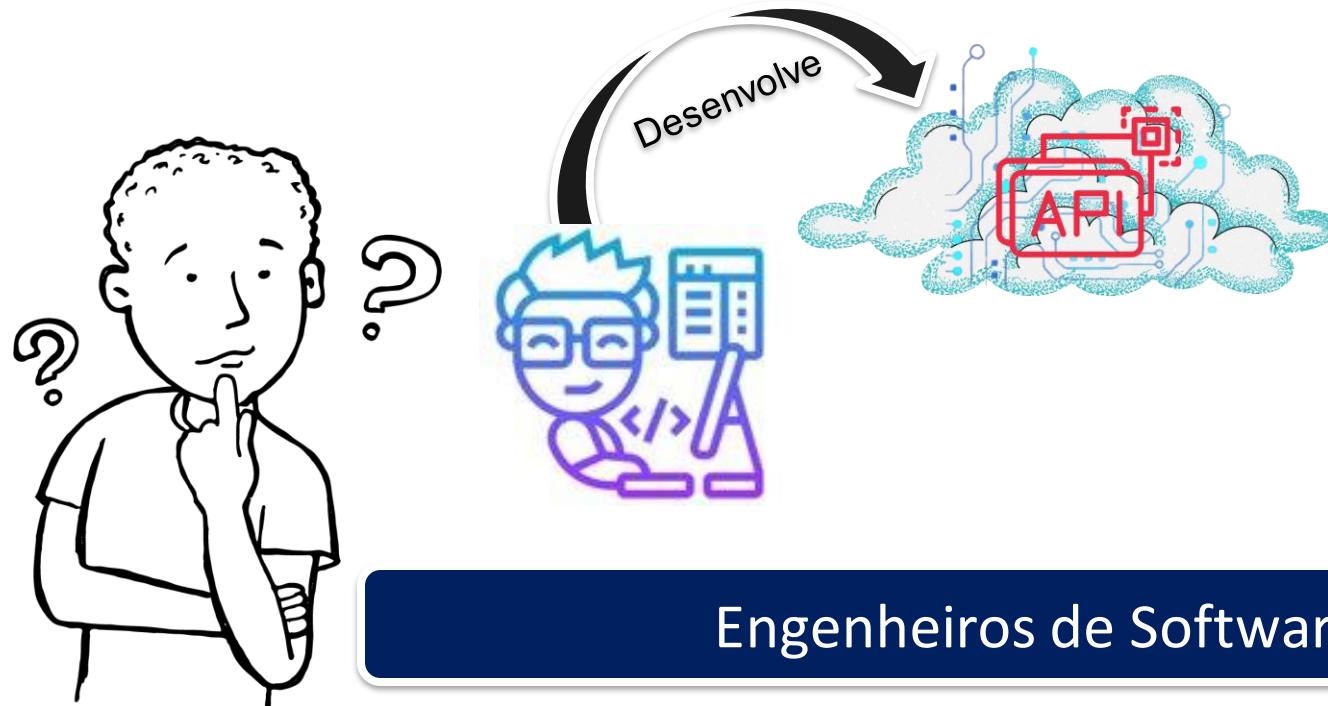


Diversas facilidades são implementadas para os users do SGBD

# Atores

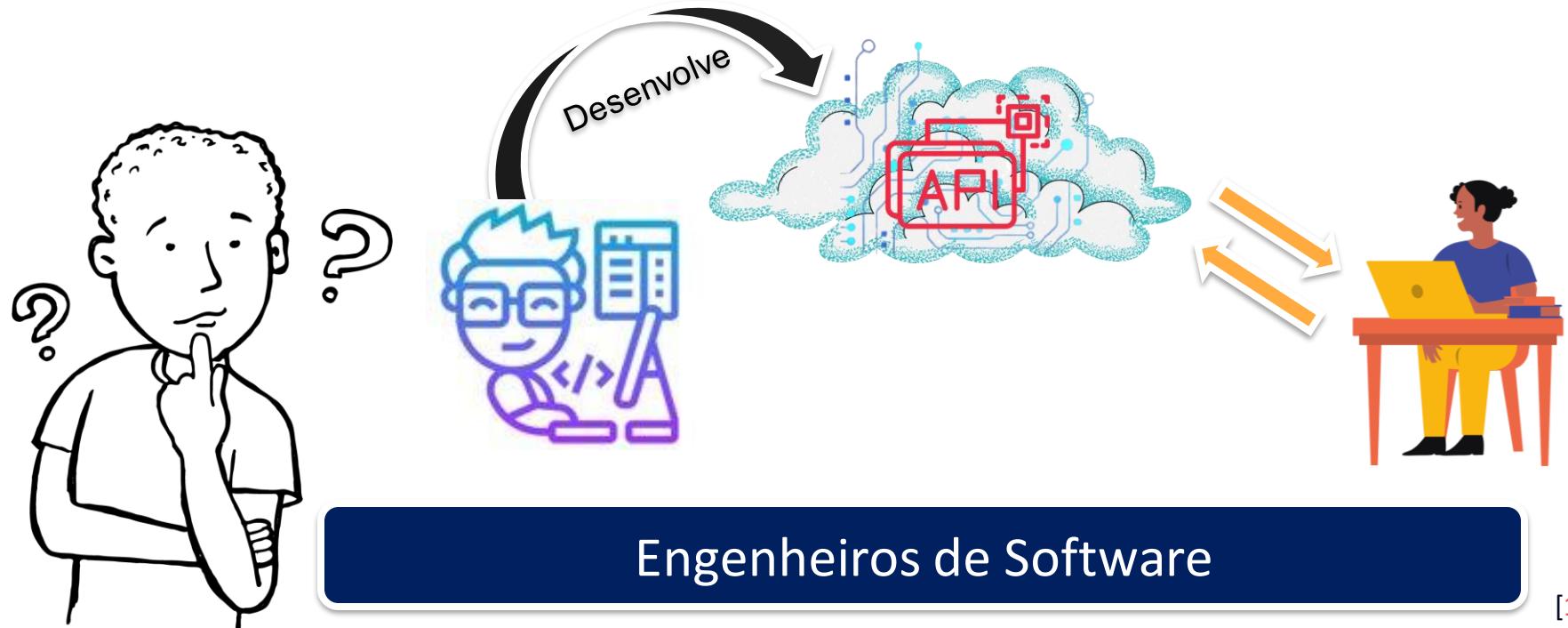


# Atores

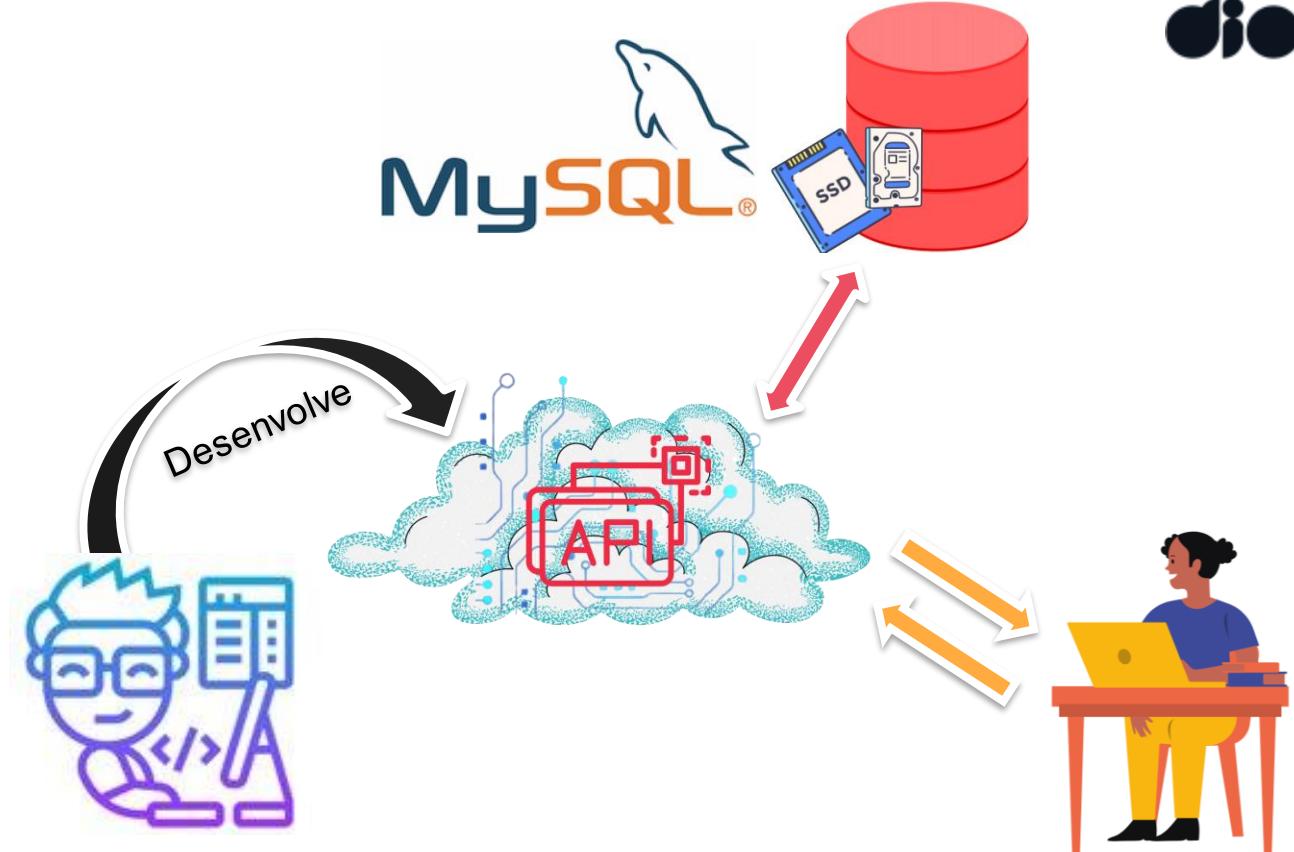


Engenheiros de Software

# Atores



# Atores



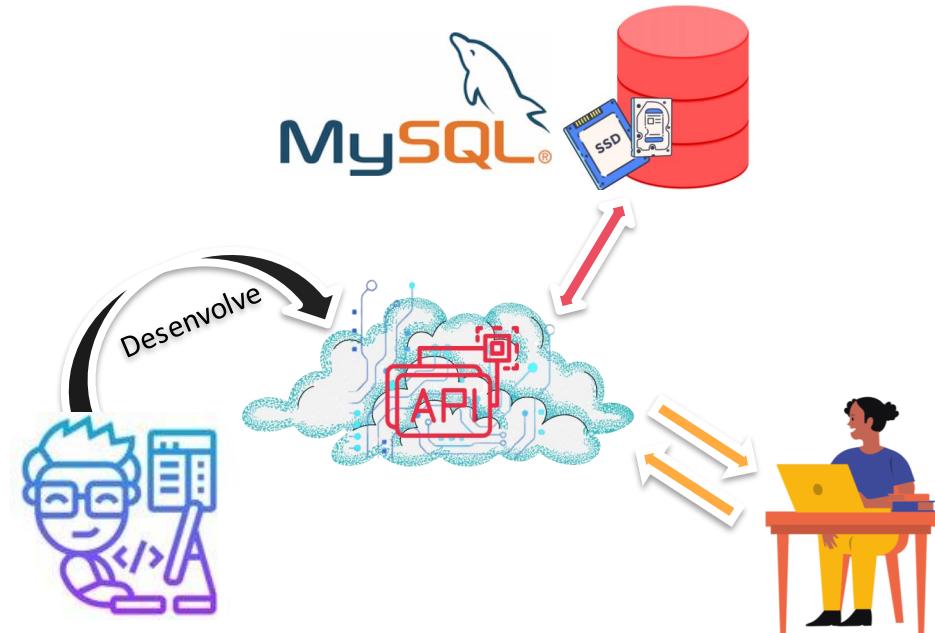
Engenheiros de Software

# 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

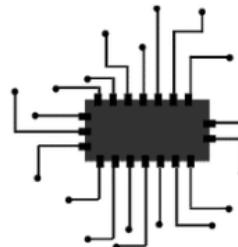
Implementação do sistema de SGBD

Desenvolvedores de ferramentas

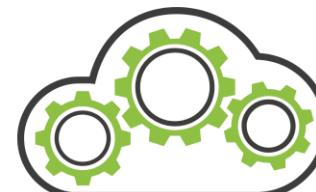
# Background



# 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

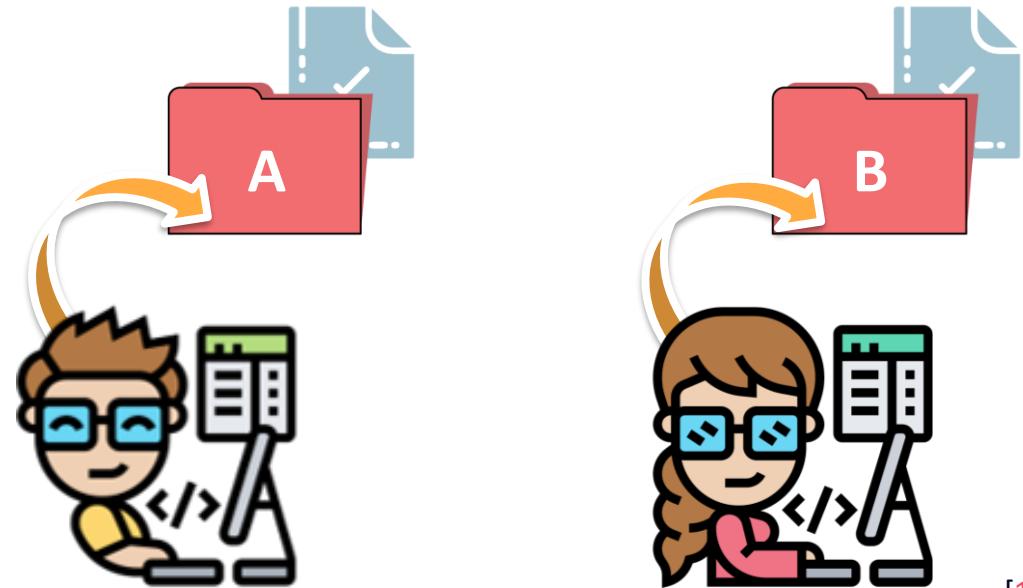
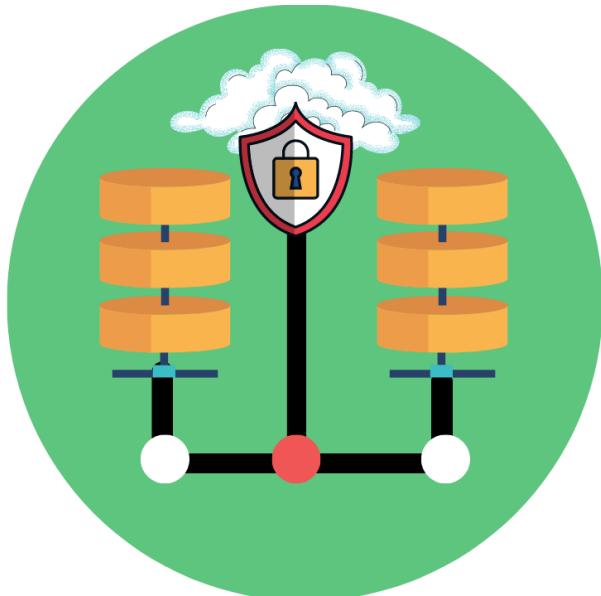
Storage – prove estrutura

Backup e Recovery

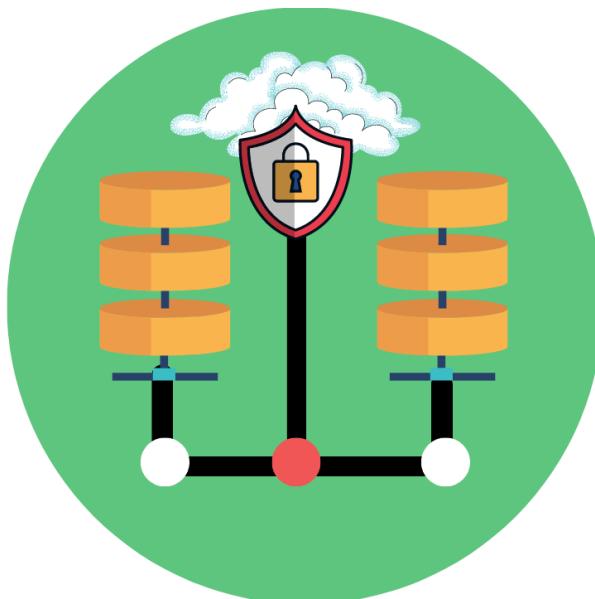


# Vantagens do SGBD

Controle de Redundância



# Vantagens do SGBD



## Controle de Redundância

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



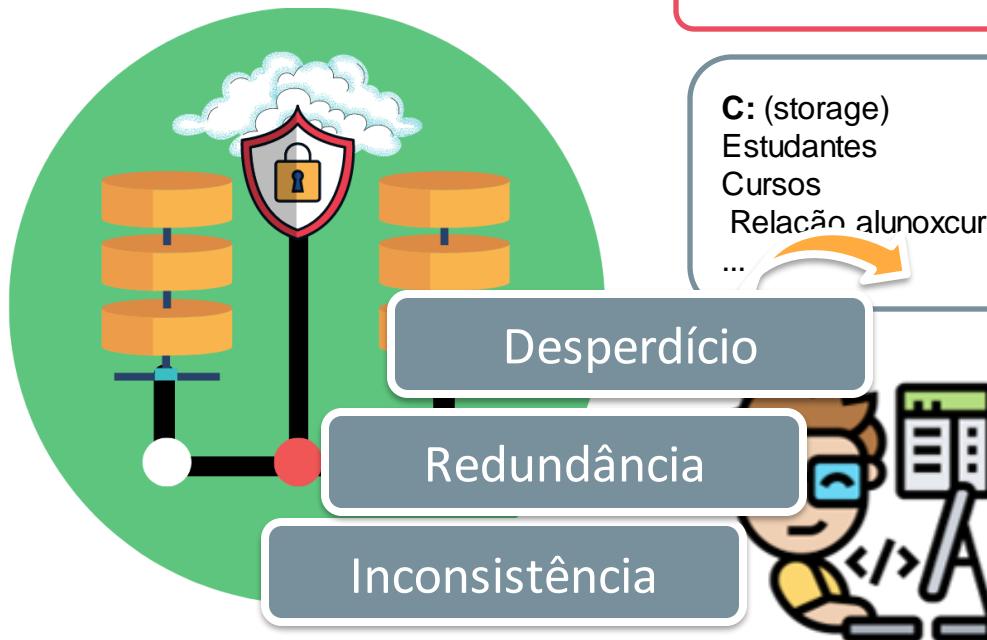
D: (storage)  
Estudantes  
Cursos  
Relação alunoxcurso  
...



# Vantagens do SGBD

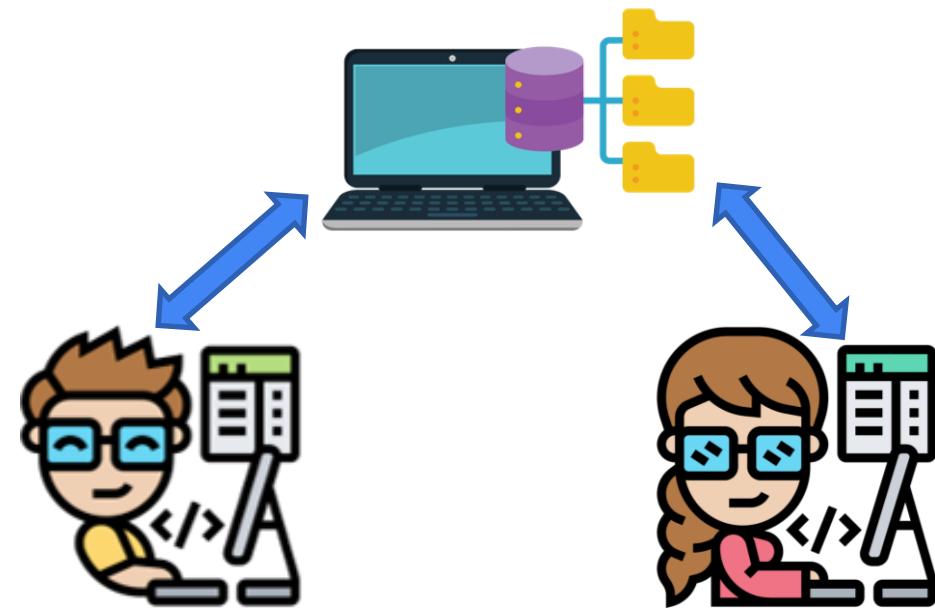
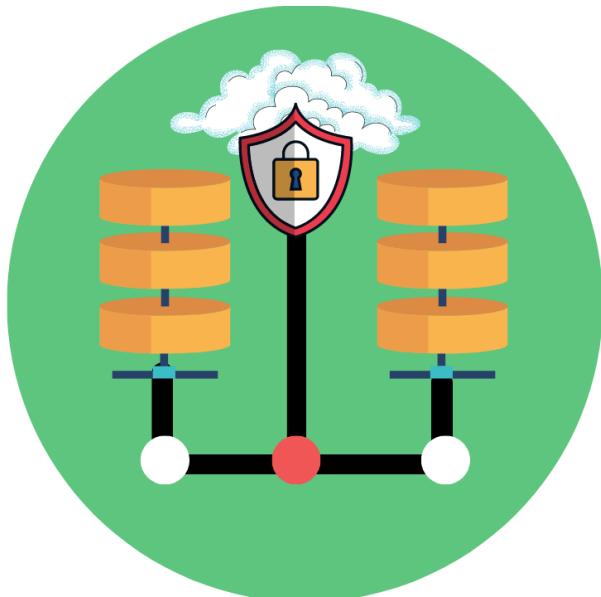
Updates desnecessários

Controle de Redundância

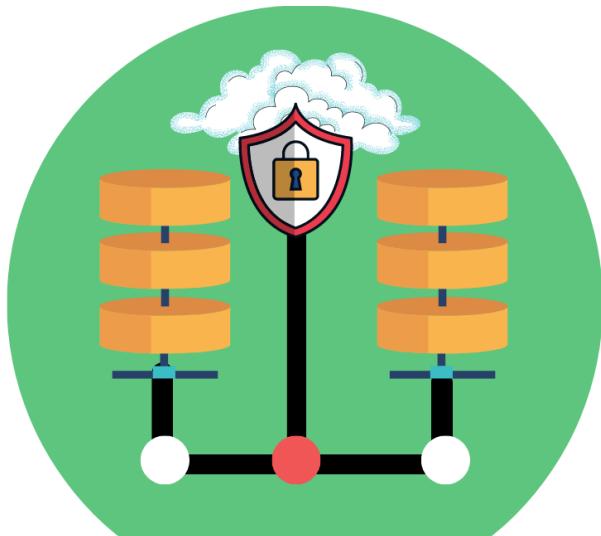


# Vantagens do SGBD

Controle de Redundância



# Vantagens do SGBD

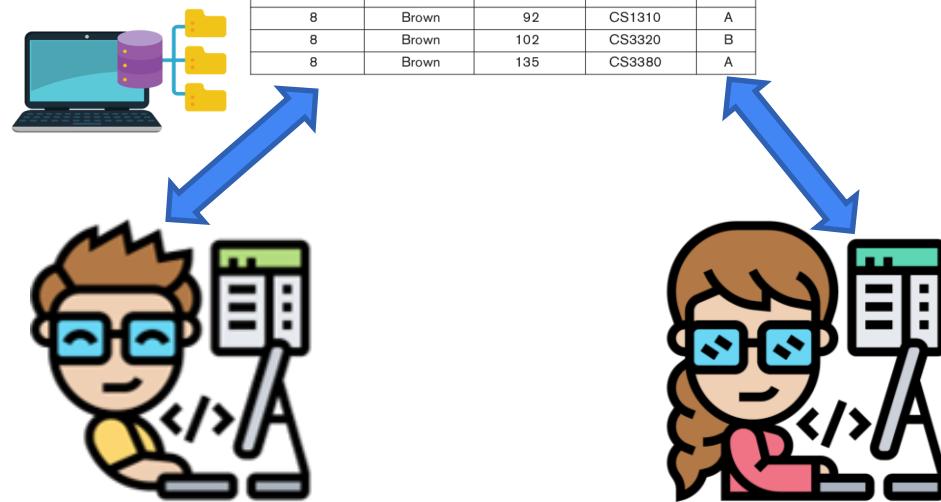


Desnormalização

## Controle de Redundância

GRADE\_REPORT

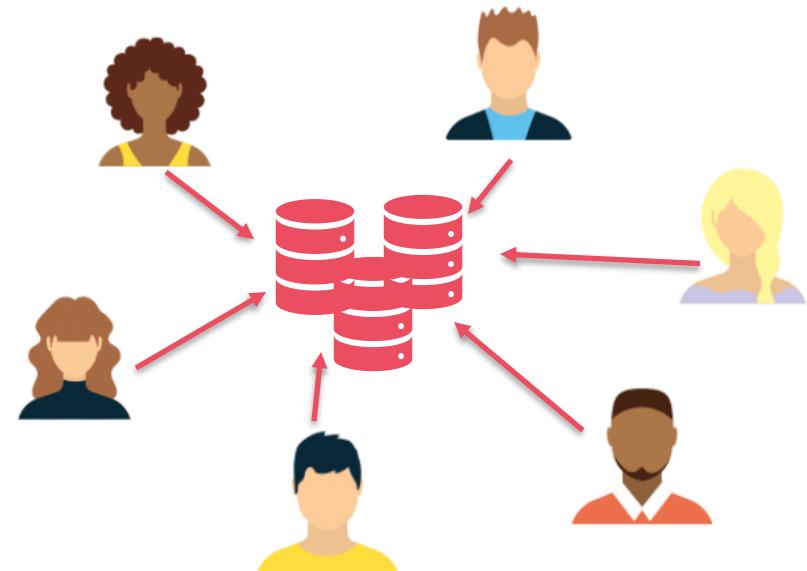
Student_number	Student_name	Section_identifier	Course_number	Grade
17	Smith	112	MATH2410	B
17	Smith	119	CS1310	C
8	Brown	85	MATH2410	A
8	Brown	92	CS1310	A
8	Brown	102	CS3320	B
8	Brown	135	CS3380	A



# Vantagens do SGBD



Restrição de acesso

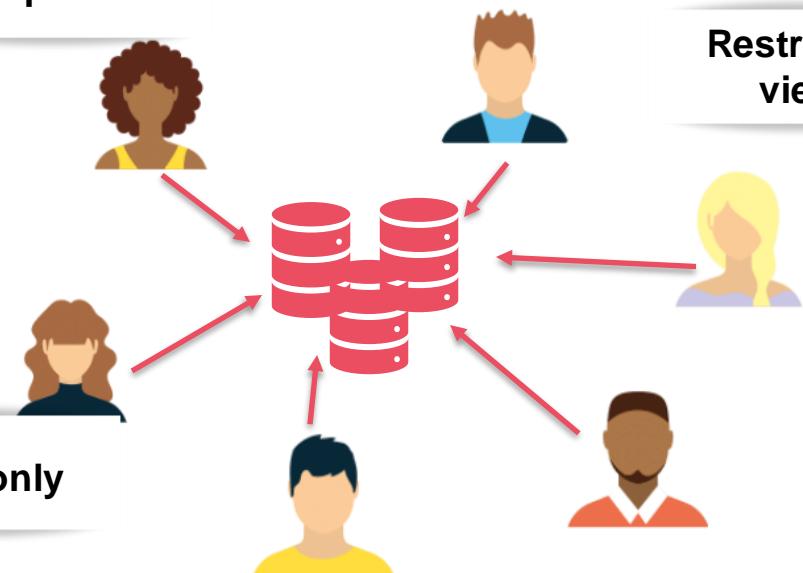


# Vantagens do SGBD



Restrição de acesso

Update



Restricted  
view

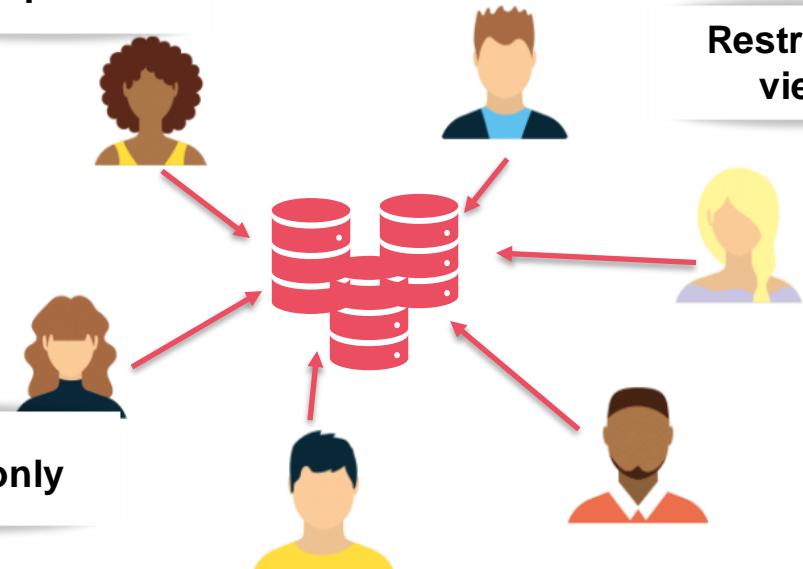
# Vantagens do SGBD

DBA



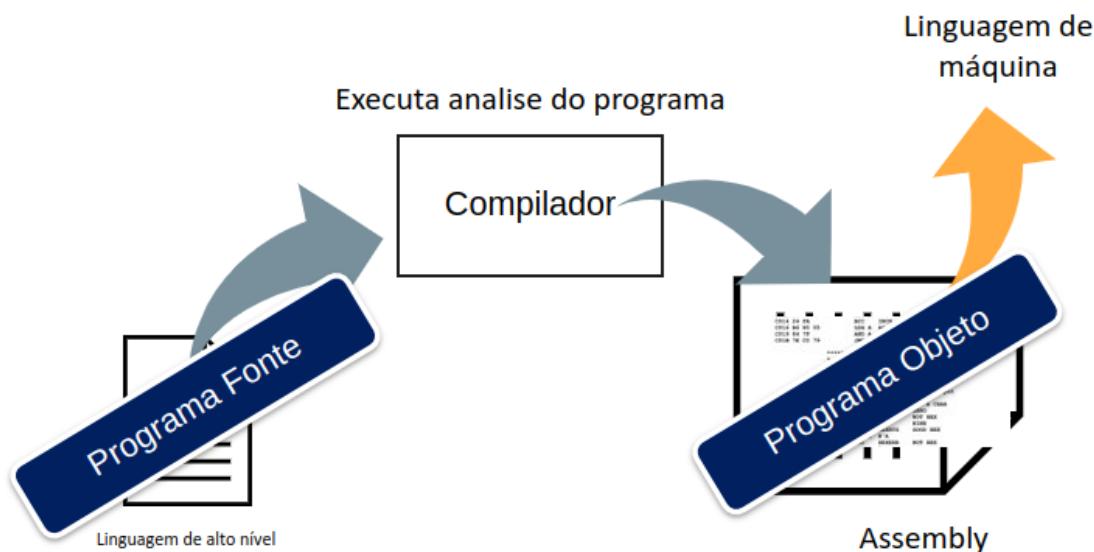
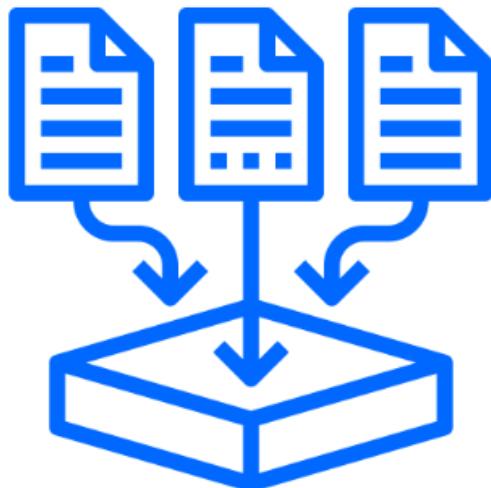
Restrição de acesso

Update



# Vantagens do SGBD

Provendo Persistência

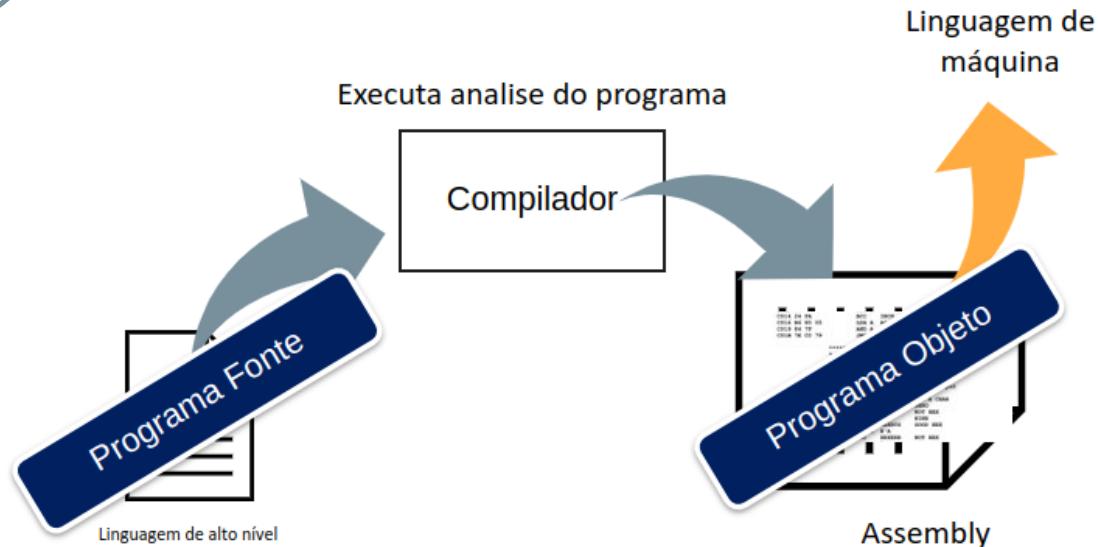


# Vantagens do SGBD

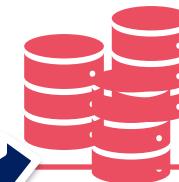
O que acontece com  
os dados de um  
programa objeto?



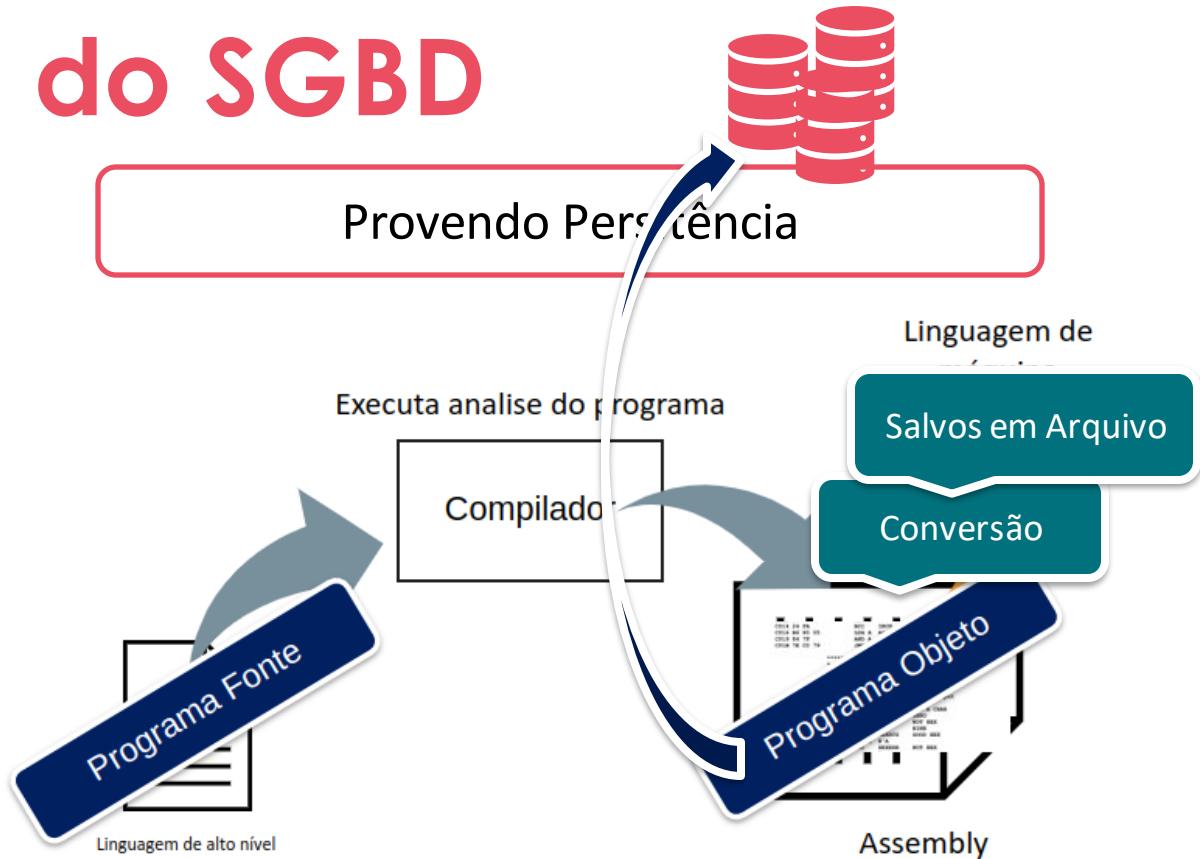
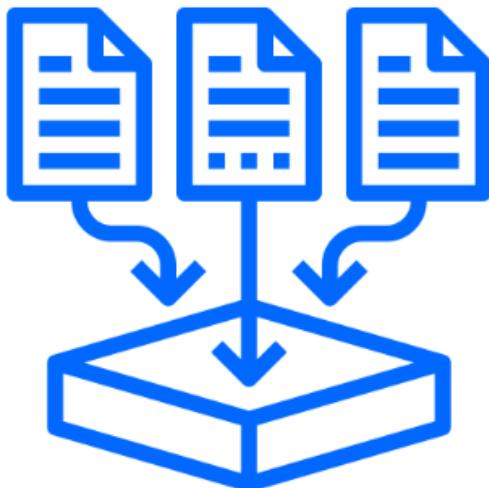
## Provendo Persistência



# Vantagens do SGBD

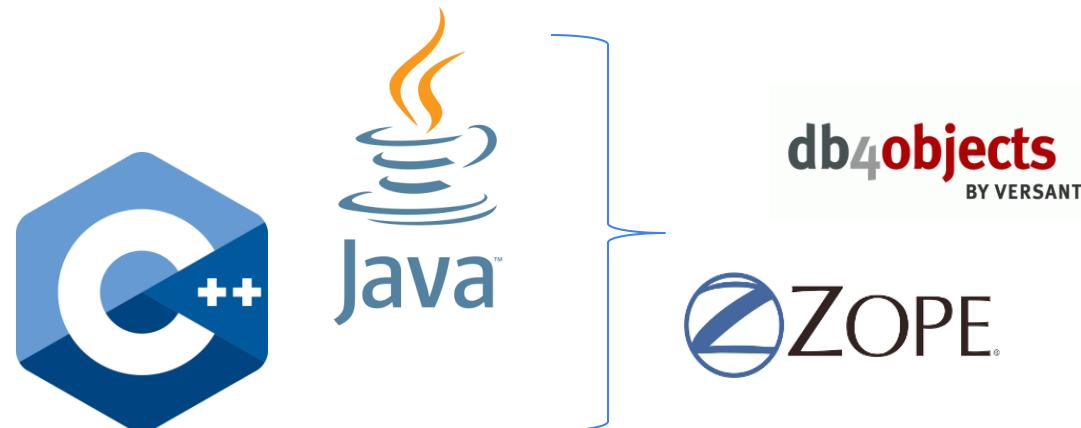
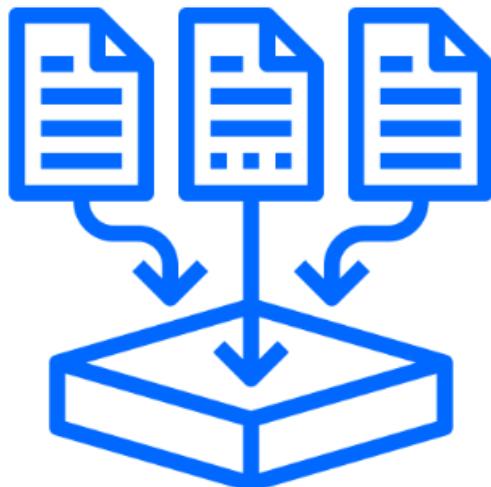


Provendo Persistência



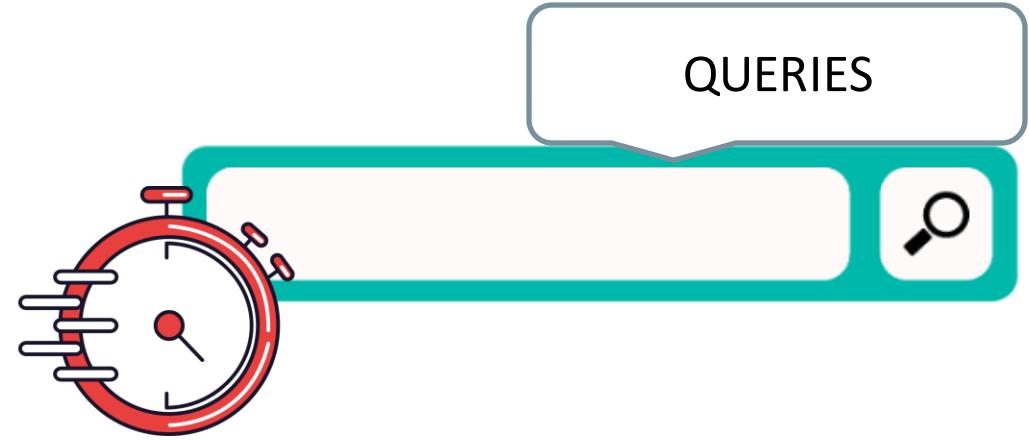
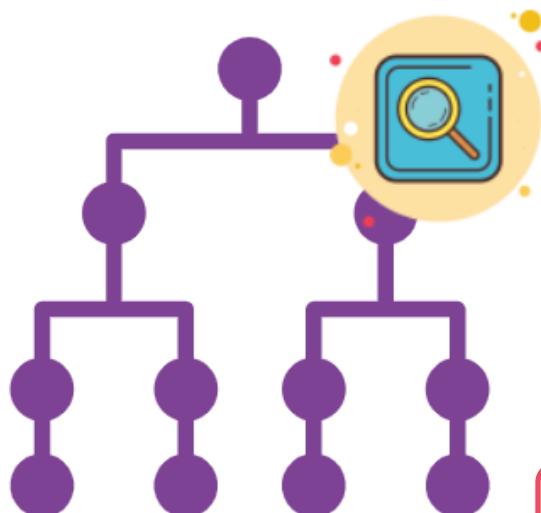
# Vantagens do SGBD

Provendo Persistência



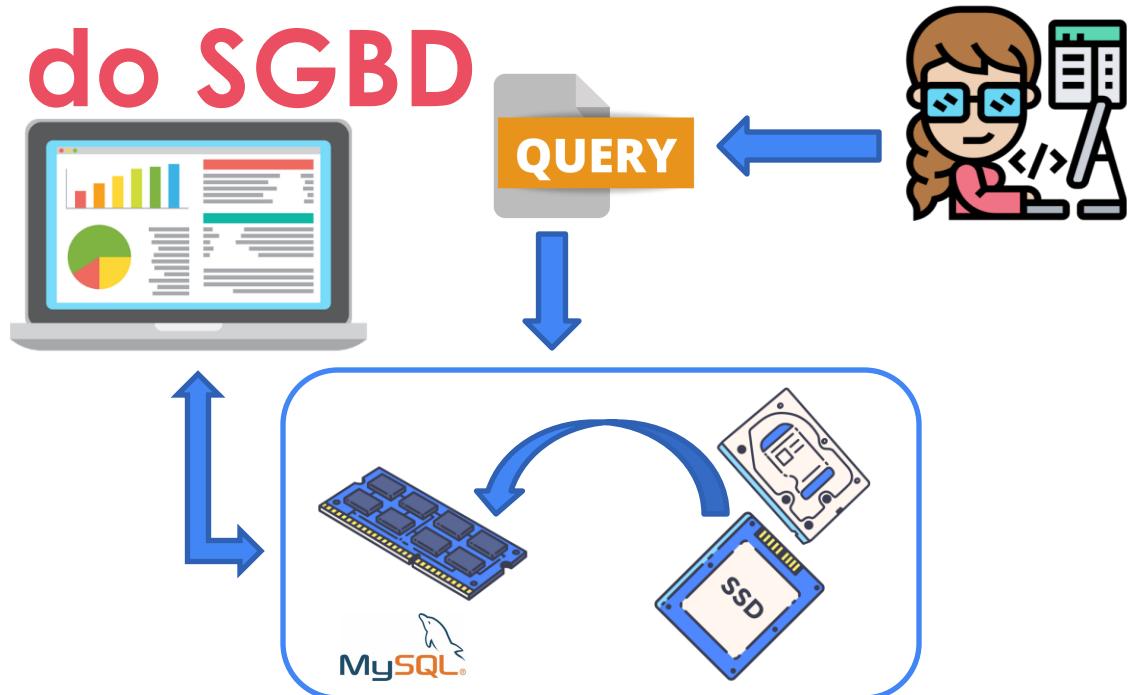
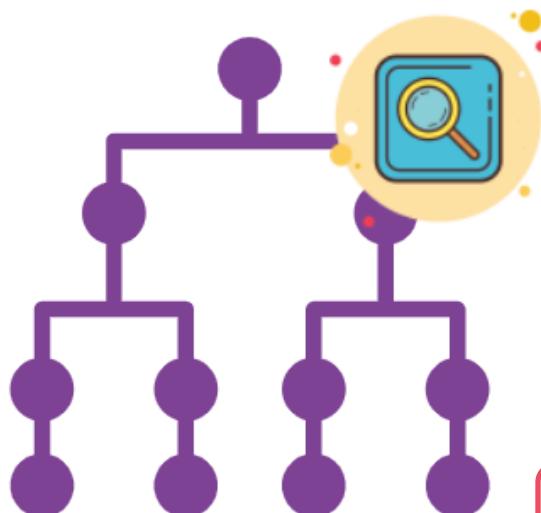
Impedance Mismatch Problem

# Vantagens do SGBD



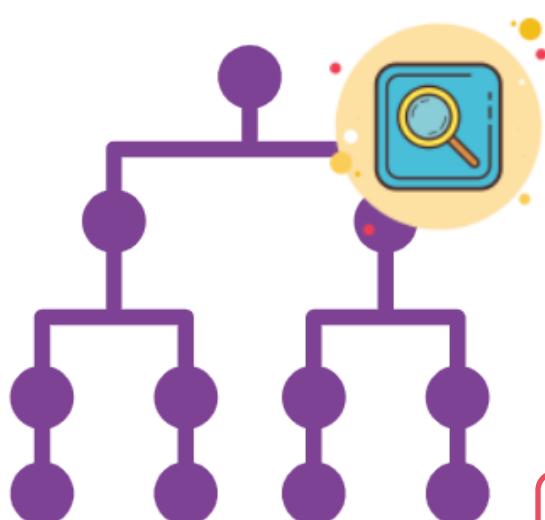
Estrutura de armazenamento e Técnicas de busca

# Vantagens do SGBD



Estrutura de armazenamento e Técnicas de busca

# Vantagens do SGBD



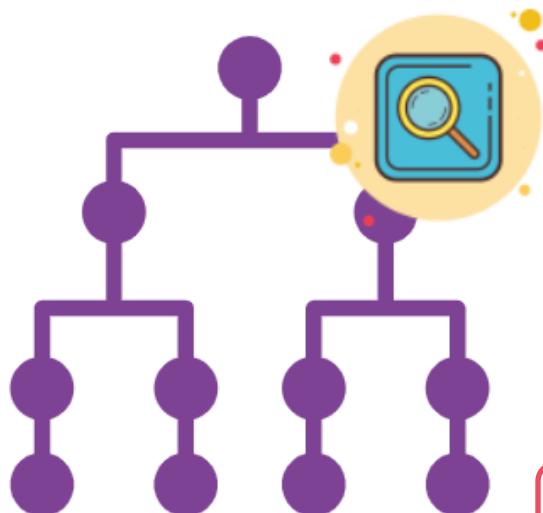
```
SELECT course_nome FROM COURSES WHERE  
Credit_hours = MAX(Credit_hours)
```

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

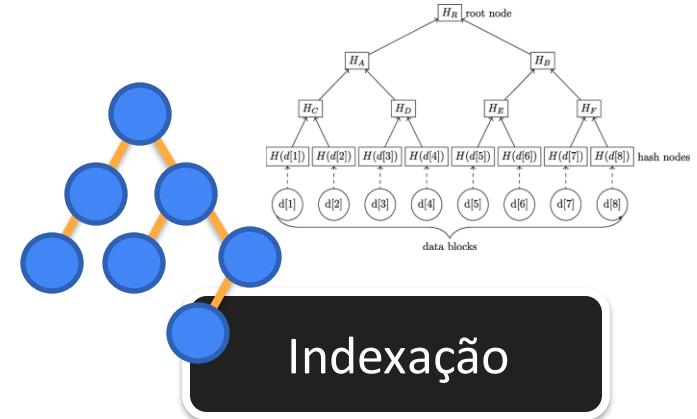
# Vantagens do SGBD



Caching

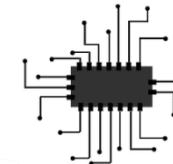
Buffering

Estrutura de armazenamento e Técnicas de busca

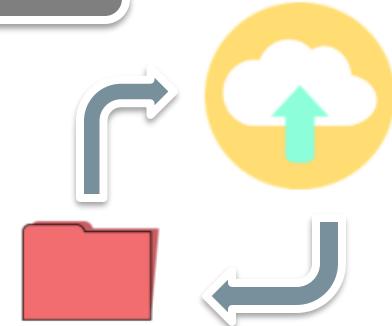


# Vantagens do SGBD

Backup e Recovery

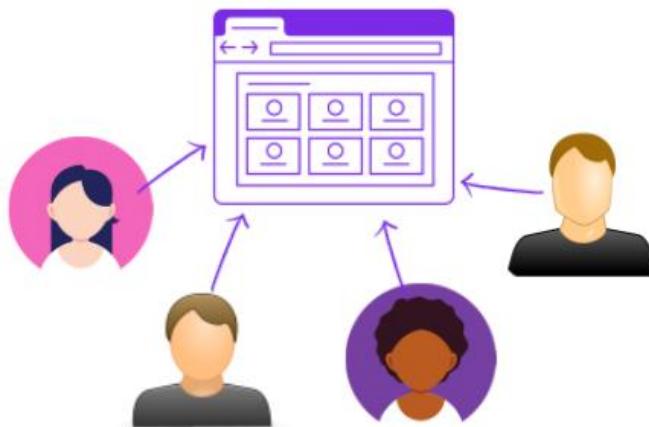


Recursos de Recovery



# Vantagens do SGBD

Provendo interface Multi-user



Perfis de usuário

Interfaces

# Vantagens do SGBD

Mobile apps

Provendo interface Multi-user

Natural Language Interface

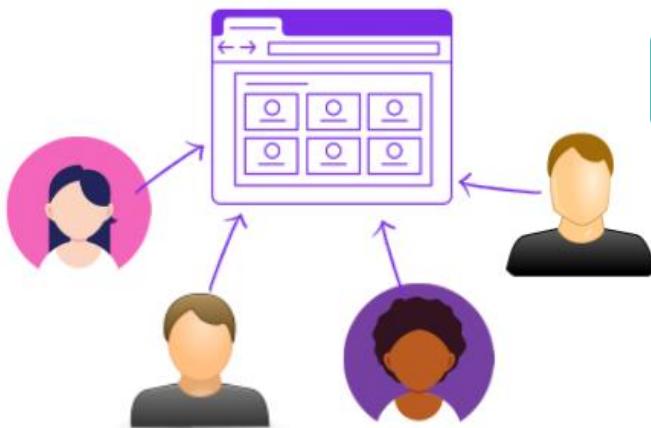
Query language

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

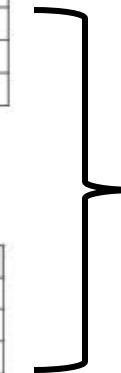


COURSE

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

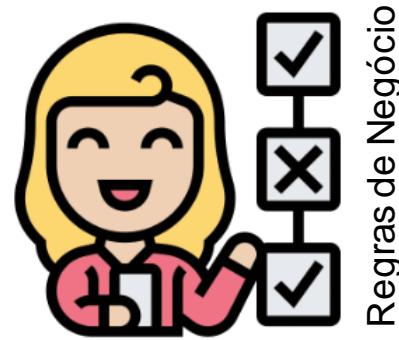
Gatilhos

Dependências Funcionais

Constrains and Triggers

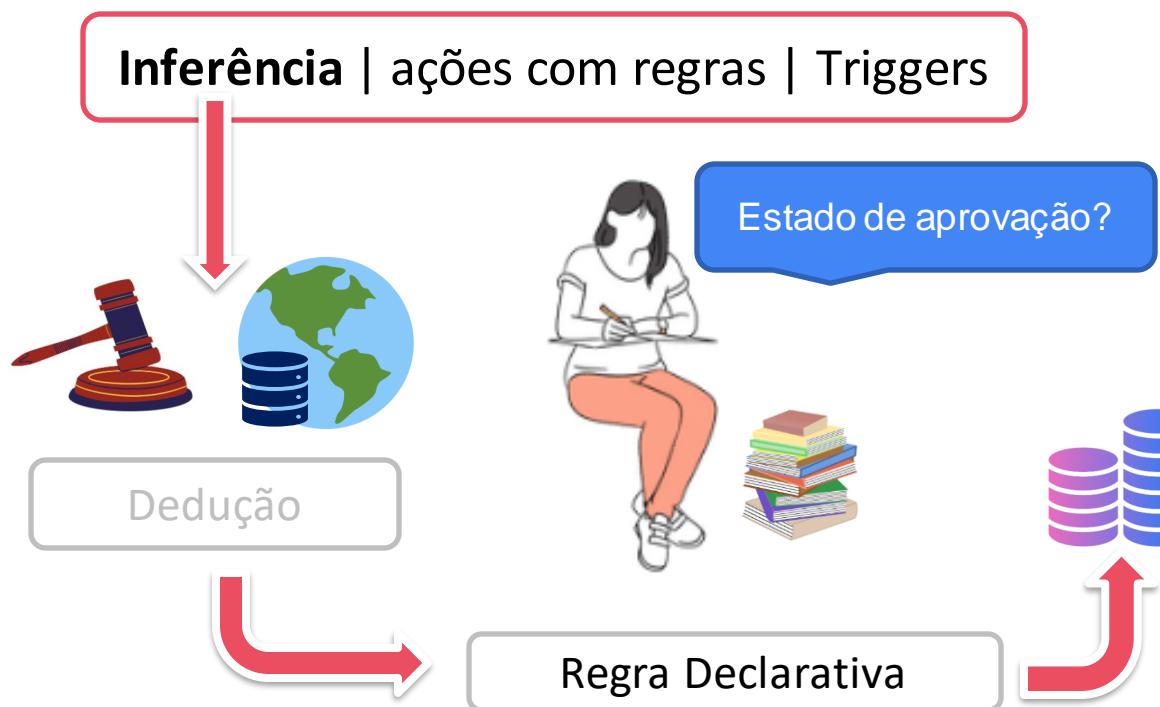
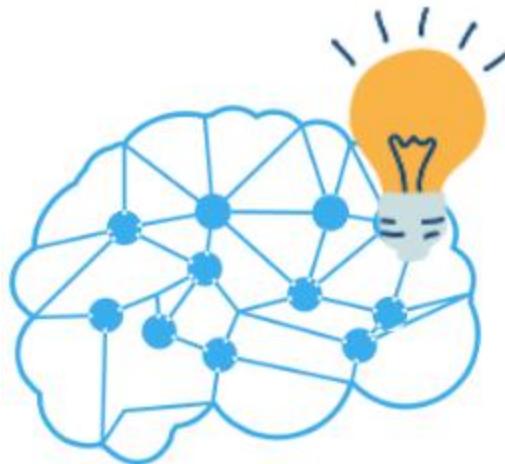
# Vantagens do SGBD

Integridade de dados

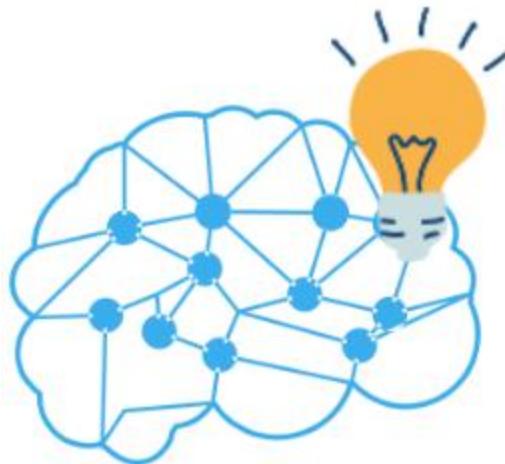


Semântica

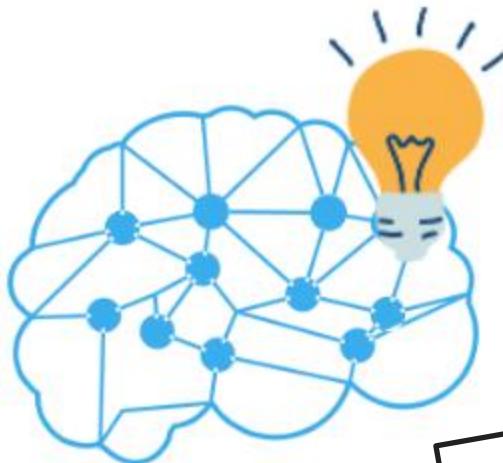
# Vantagens do SGBD



# Vantagens do SGBD



# Vantagens do SGBD



Inferência | ações com regras | Triggers

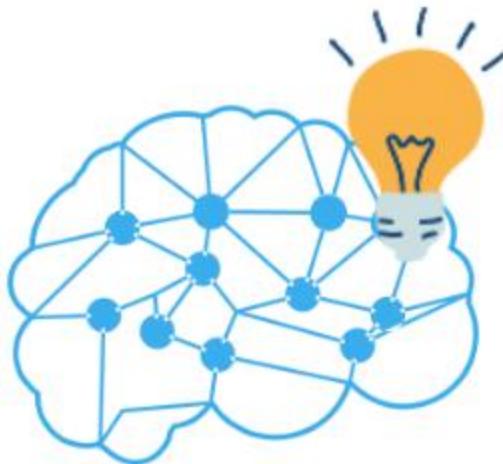
Regras e dedução

Prog. Procedural

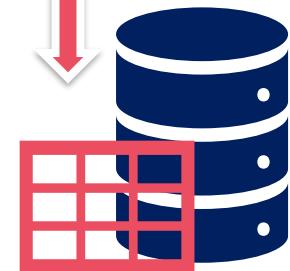
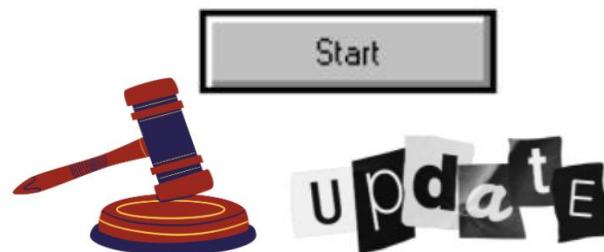
Regra Declarativa



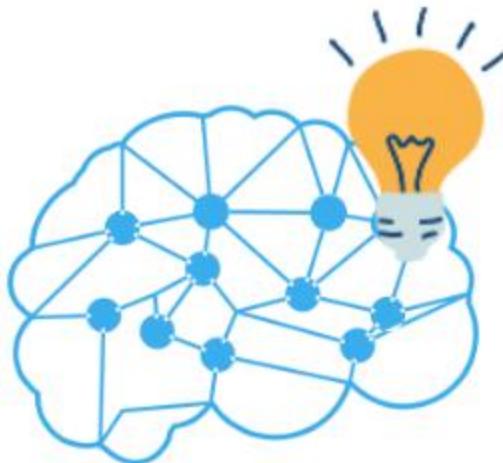
# Vantagens do SGBD



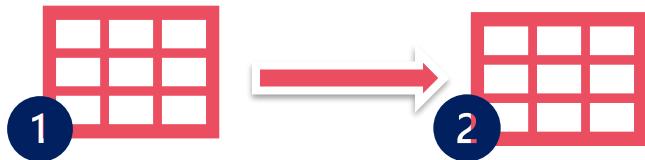
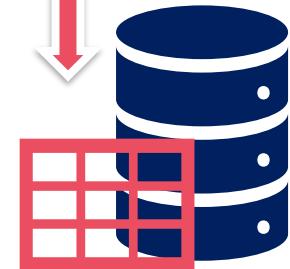
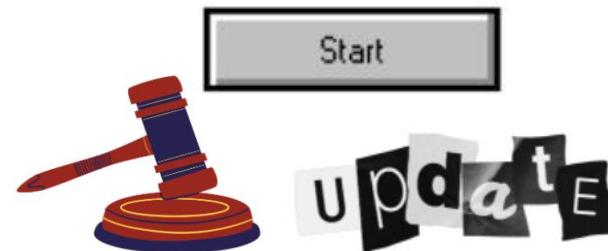
Inferência | ações com regras | Triggers



# Vantagens do SGBD



Inferência | ações com regras | Triggers



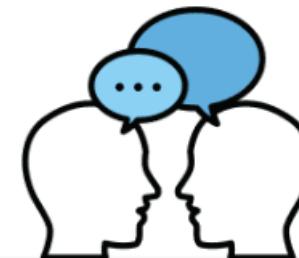
# Ganhos em utilizar Sistemas de Gerenciamento de Banco de Dados



# 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

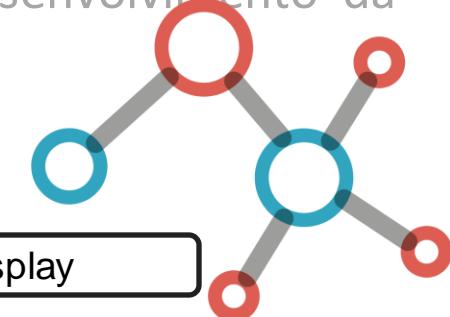
• Flexibilidade

• 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

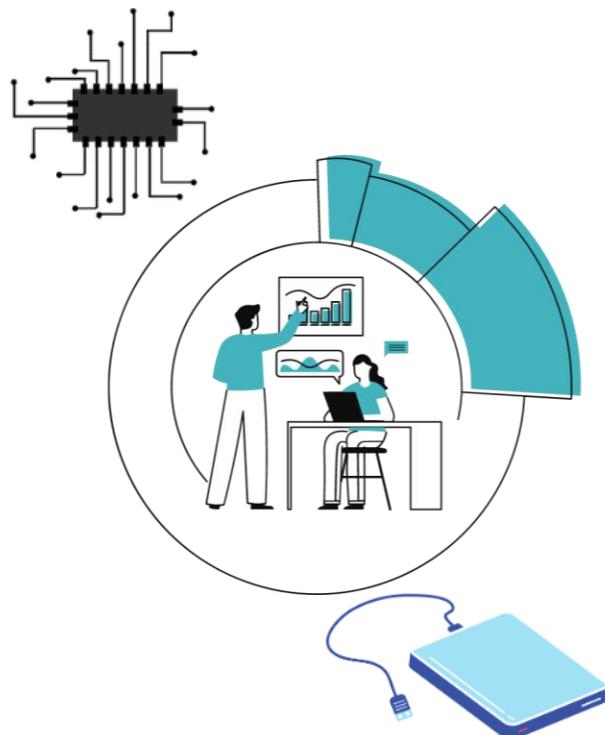


- Padronização
- Redução de tempo no desenvolvimento da aplicacão
- Flexibilidade
- Disponibilidade de info up-to-date
- Economia com escalabilidade

Update imediato



# Ganhos com SGBD



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

Operacional & Gerenciamento



Overlap

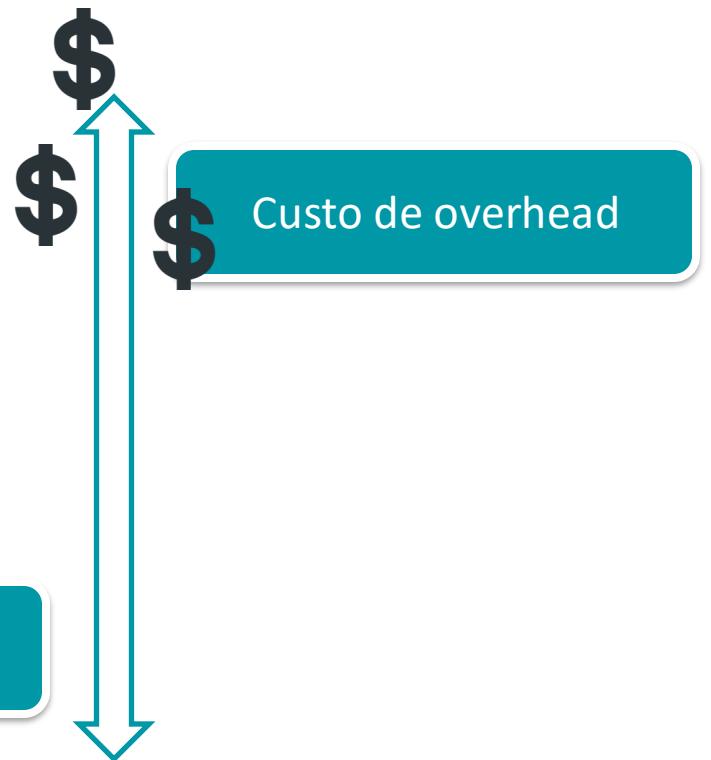
# Quando não usar um SGBD?



# Not use!



Custo-benefício



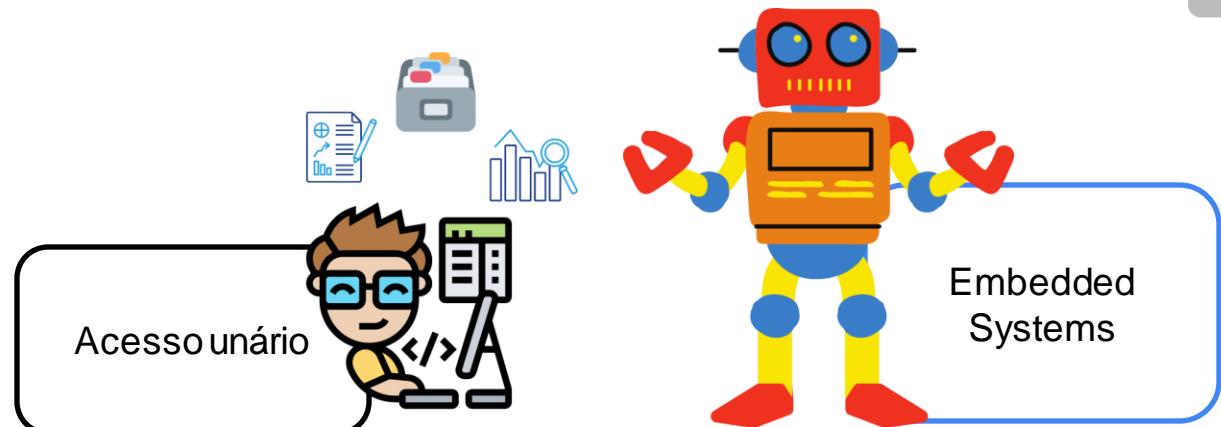
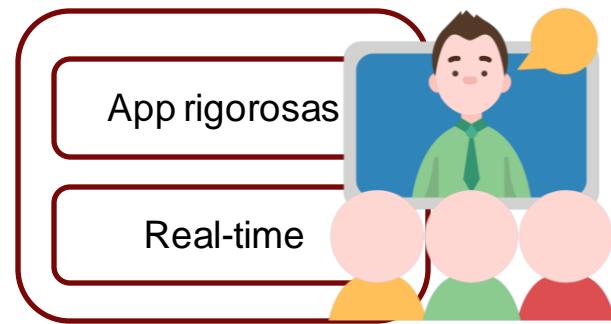
# Not use!



Custo

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

# Not use!

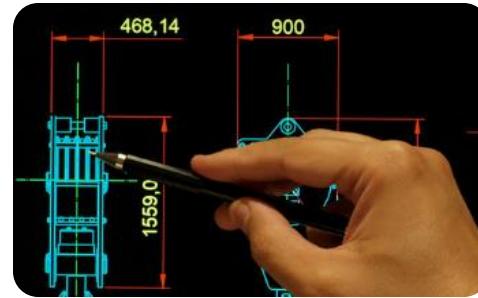


Situações

# Not use!



COMUTAÇÃO



GIS Systems

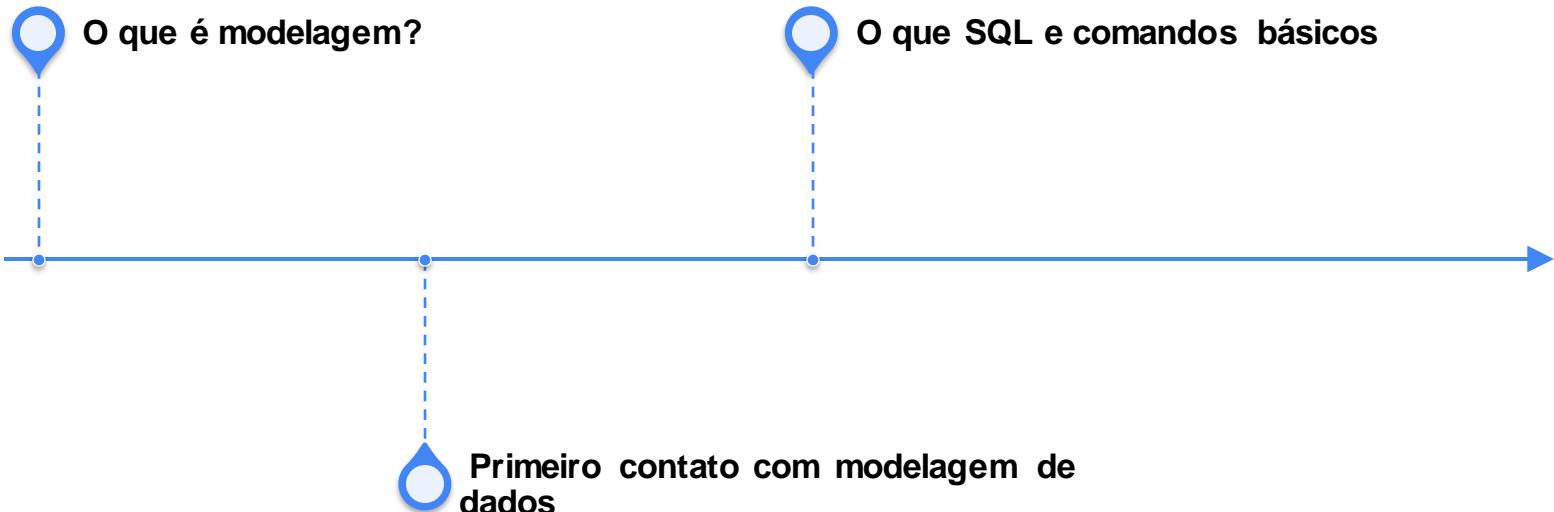


## Etapa 7

# 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

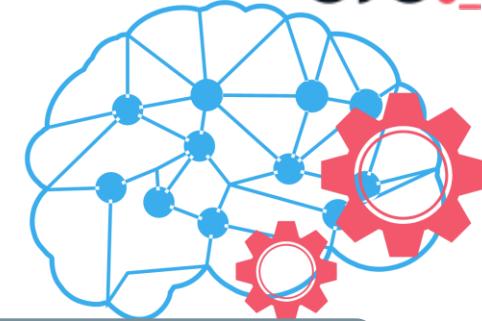


Modelagem

Representação

Modelo

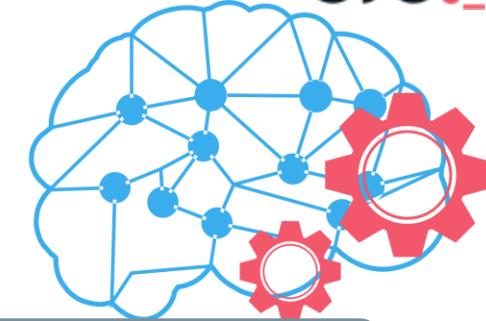
Referência



# Modelagem



Modelagem



Software

Dados

Computacional

Conceitual

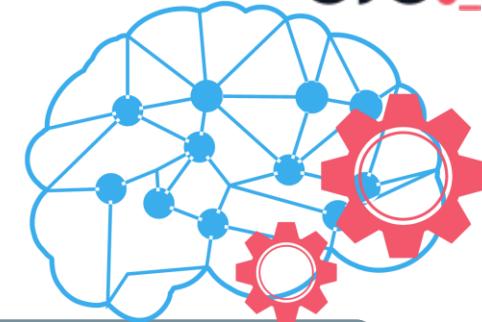
Processo de negócios

Matemática

# Modelagem



Modelagem



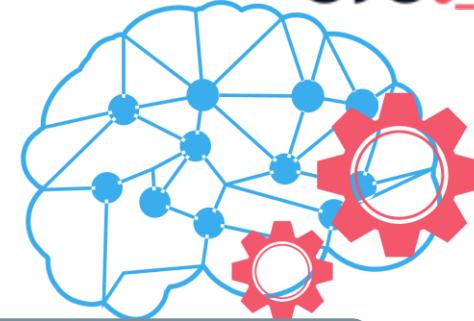
Possui foco na descrição e relacionamento dos elementos que compõem a representação do contexto (mini-mundo)



# Modelagem



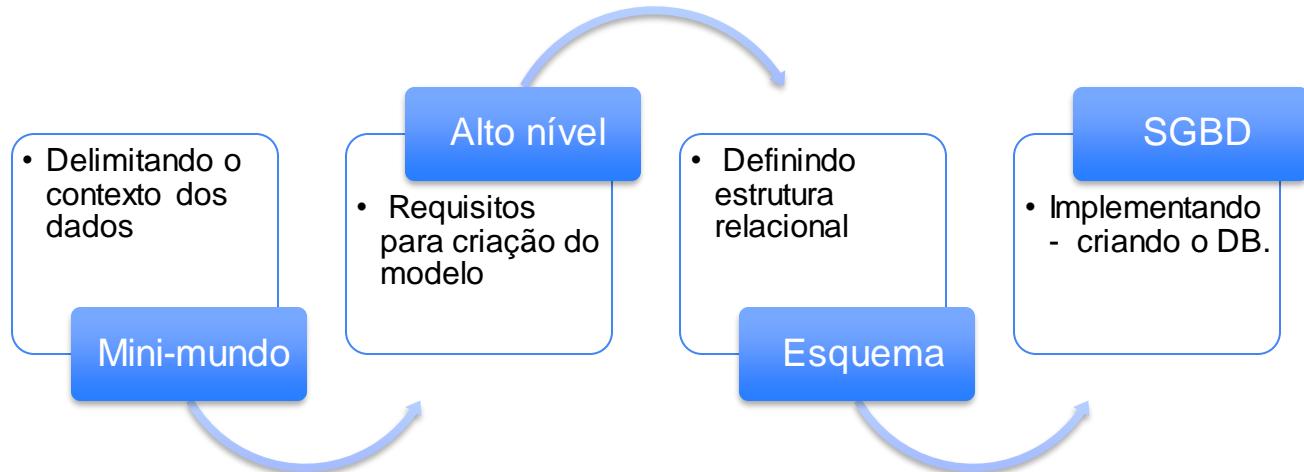
Modelagem



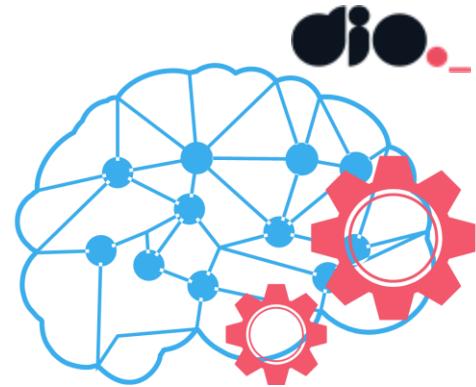
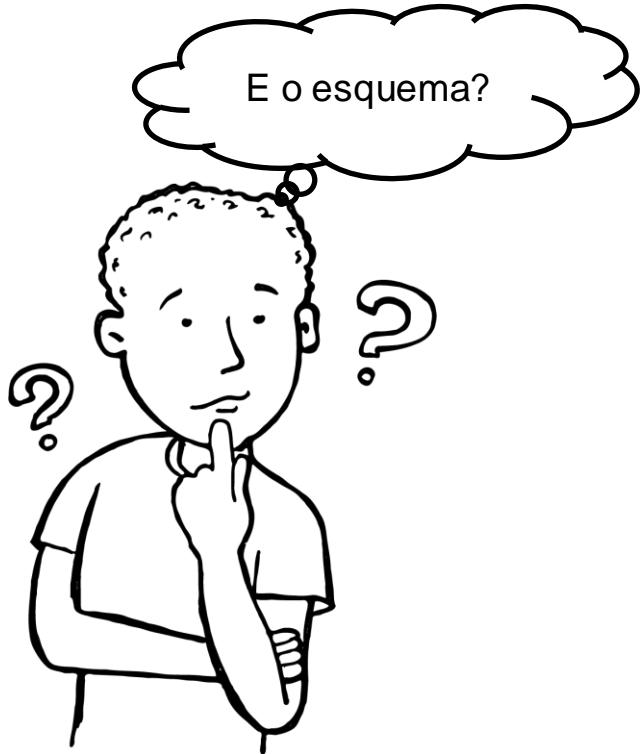
Possui foco na descrição e relacionamento dos elementos que compõem a representação do contexto (mini-mundo)



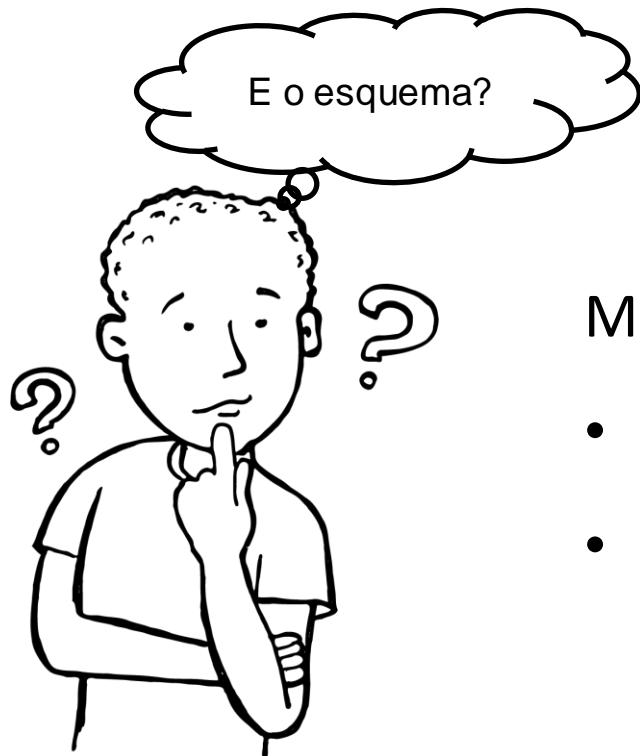
# Modelagem



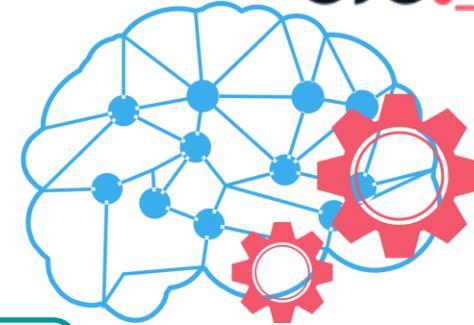
# Modelagem



# Modelagem



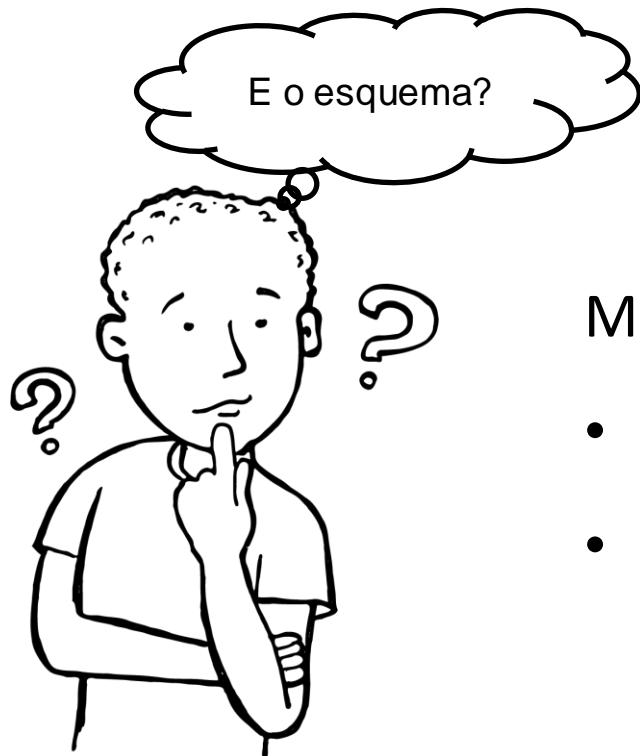
Facilita a compreensão do contexto dos dados



Modelos de alto nível:

- Entidade-Relacionamento
- UML (Unified Modeling Language)

# Modelagem



Facilita a compreensão do contexto dos dados

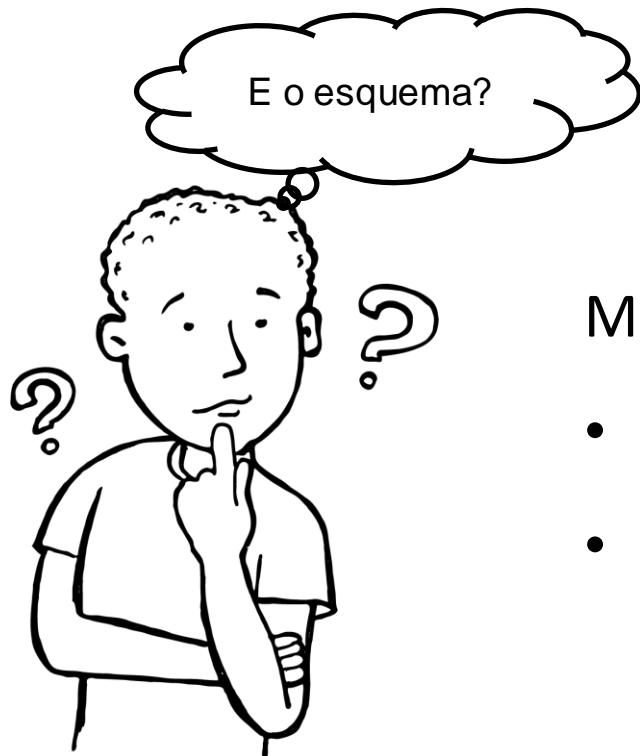
## Modelos de alto nível:

- Entidade-Relacionamento
- UML

Modelos



# Modelagem



Facilita a compreensão do contexto dos dados

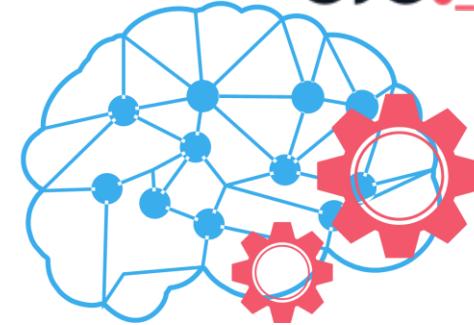
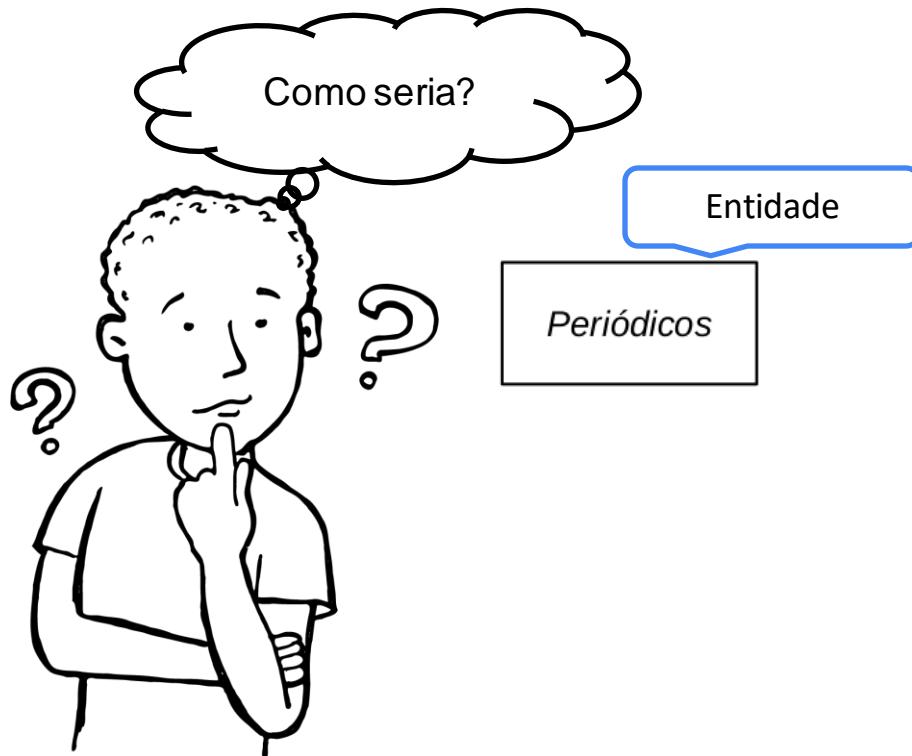
Modelos de alto nível:

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

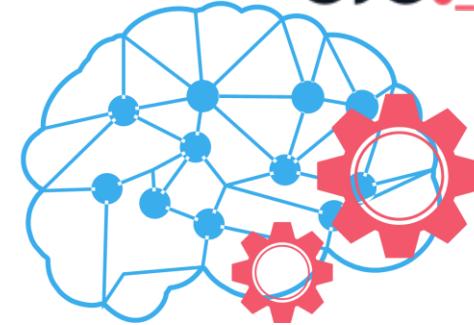
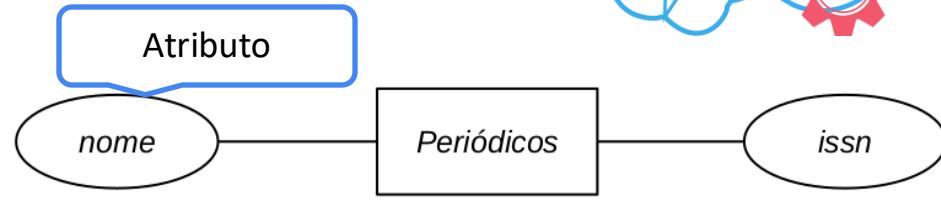
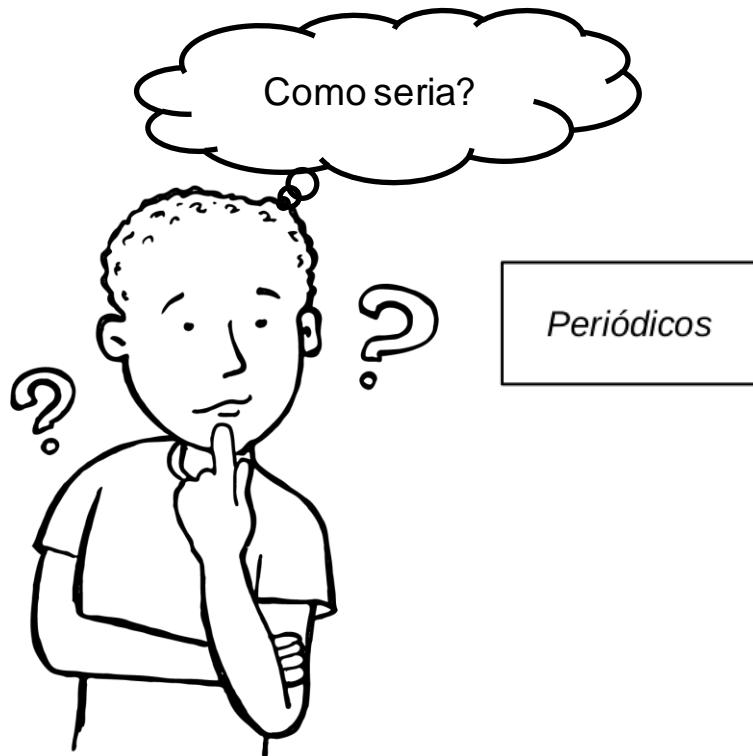
Modelos



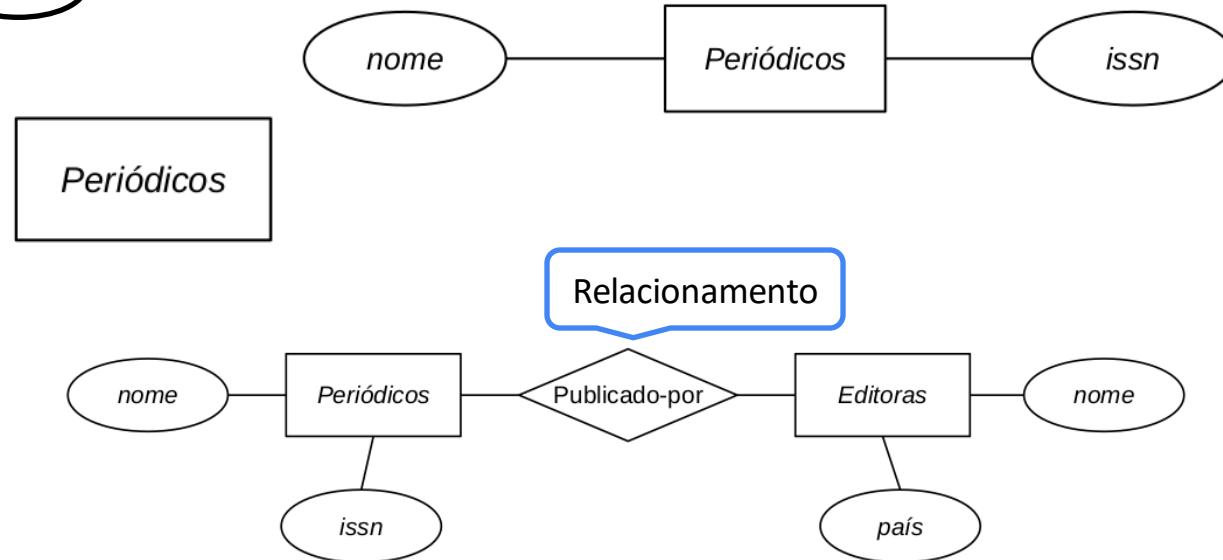
# Modelagem



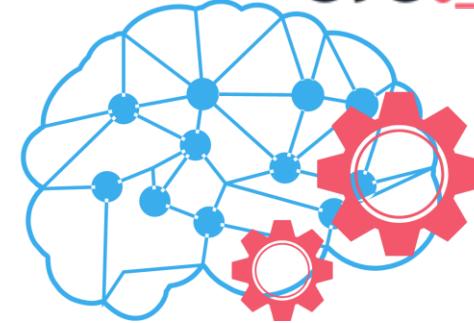
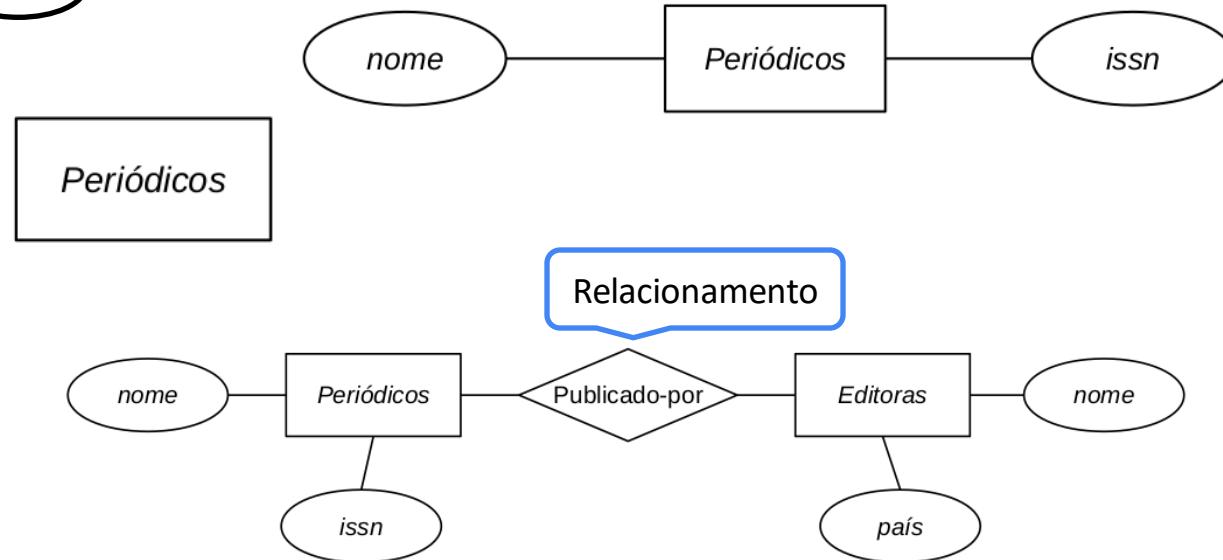
# Modelagem



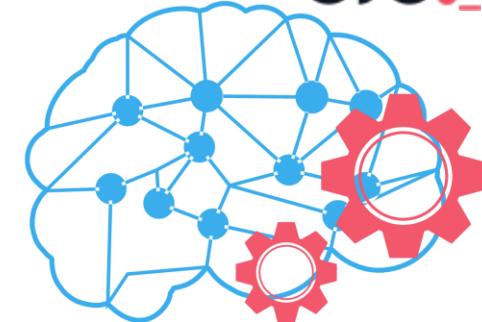
# Modelagem



# Modelagem



# Modelagem



Instâncias

Multiplicidade

Chaves e constraints

Integridade de dados ...

# Modelagem



Facilita a compreensão do contexto dos dados

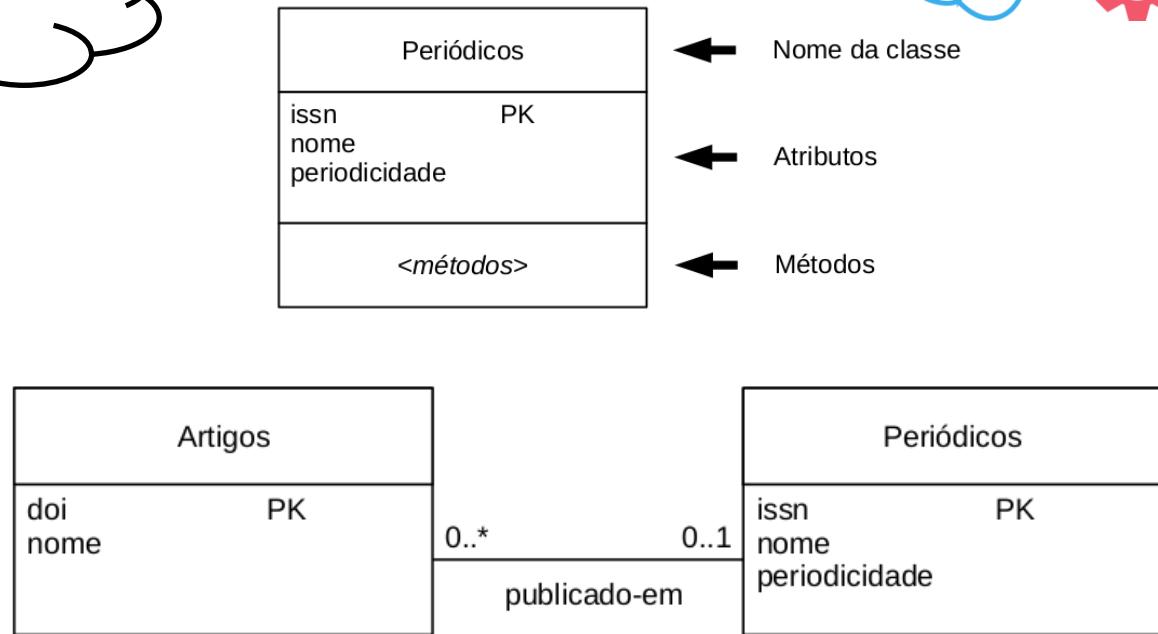
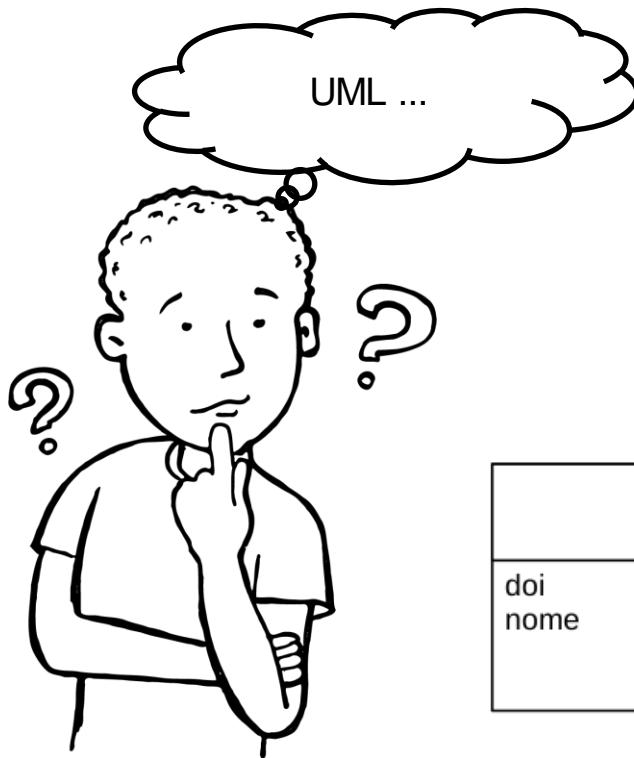
Modelos de alto nível:

- 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 & storage engines:** Lists InnoDB, BDB, MyISAM, and MEMORY storage engines.

```
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)

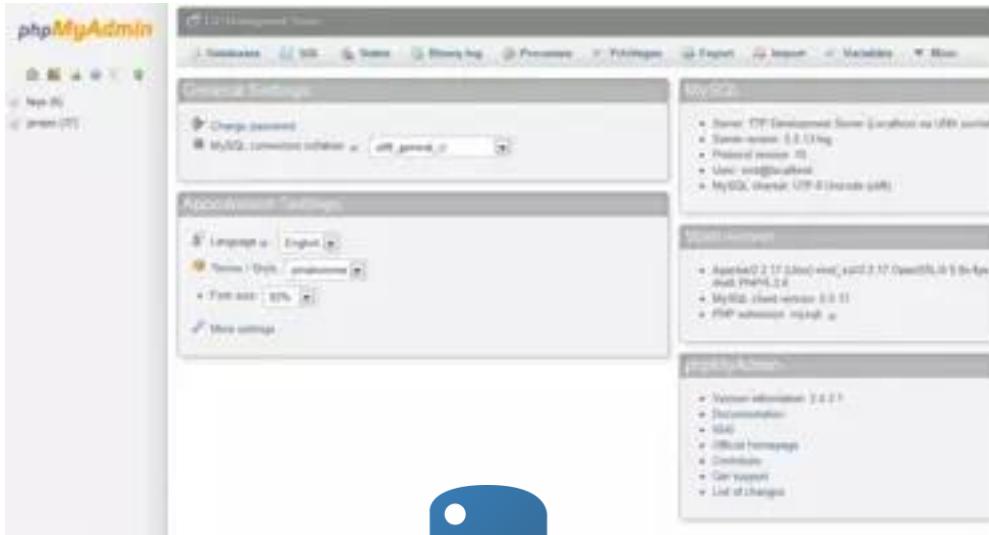
Copyright (c) 2000, 2022, Oracle and/or its affiliates.

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(
```

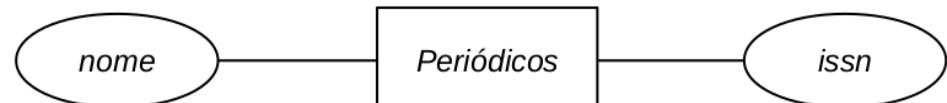
```
    id integer,
```

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

```
    issn integer
```

```
);
```

Criando a tabela periódicos



# SQL – 1º exemplo

```
CREATE DATABASE firstexample;
```

```
CREATE TABLE periodicos(
```

```
    id integer,
```

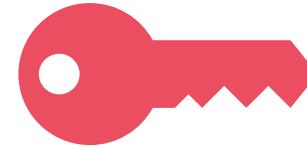
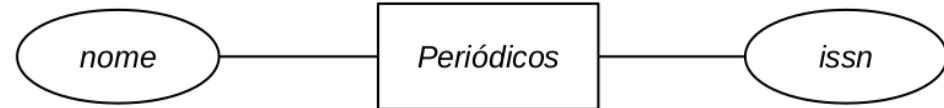
```
    nome varchar
```

```
    issn :
```

Como garantir unicidade?

```
);
```

Criando a tabela periódicos



Primary Key

# SQL – 1º exemplo

```
CREATE DATABASE firstexample;
```

```
CREATE TABLE periodicos(
```

```
    id integer,
```

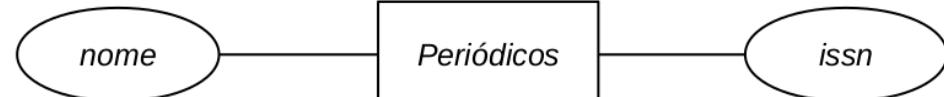
```
    nome varchar(120),
```

```
    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),
```

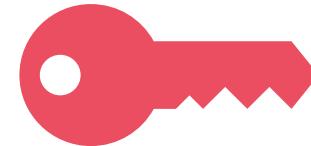
```
    issn integer,
```

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

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

```
);
```

Definindo relacionamento



# Desafio



## Etapa 8

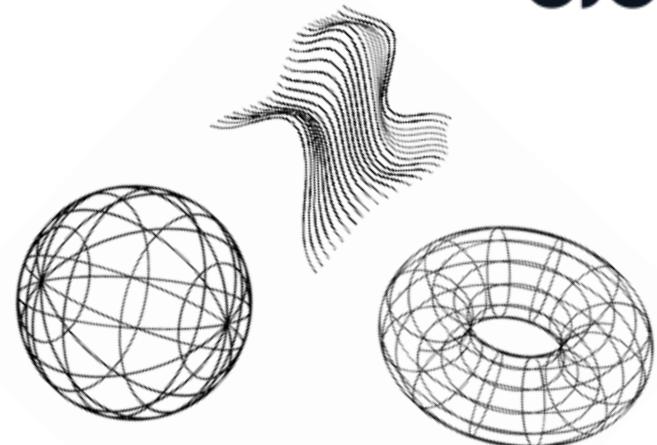
# Arquitetura: Modelos, Esquemas e Instâncias

// Introdução à Banco de dados

# Conversa



# Modelo

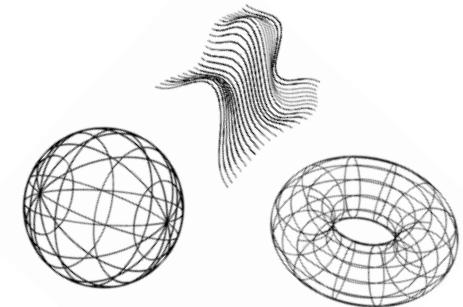
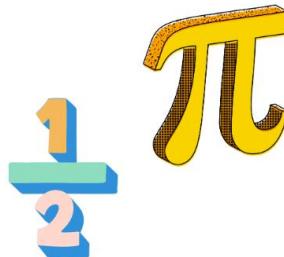


Abstração



essencial

# Modelo



Data model

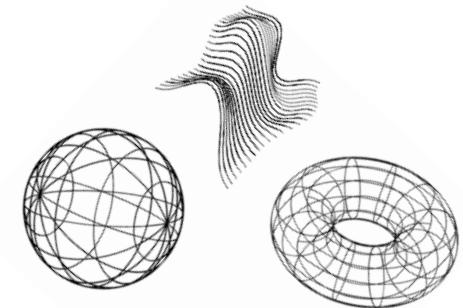
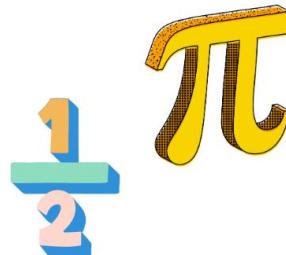


Abstração



essencial

# Modelo



Operações



Data model

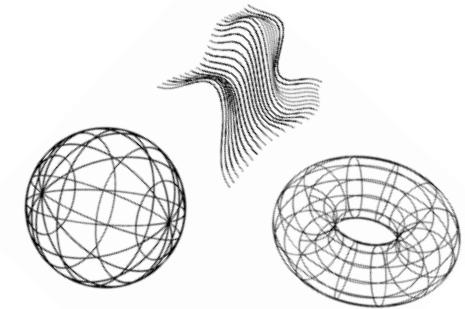
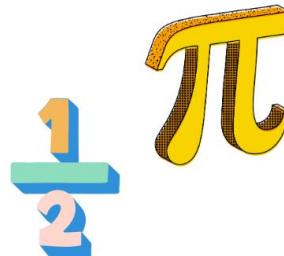


Abstração



essencial

# Modelo



Operações



Data model



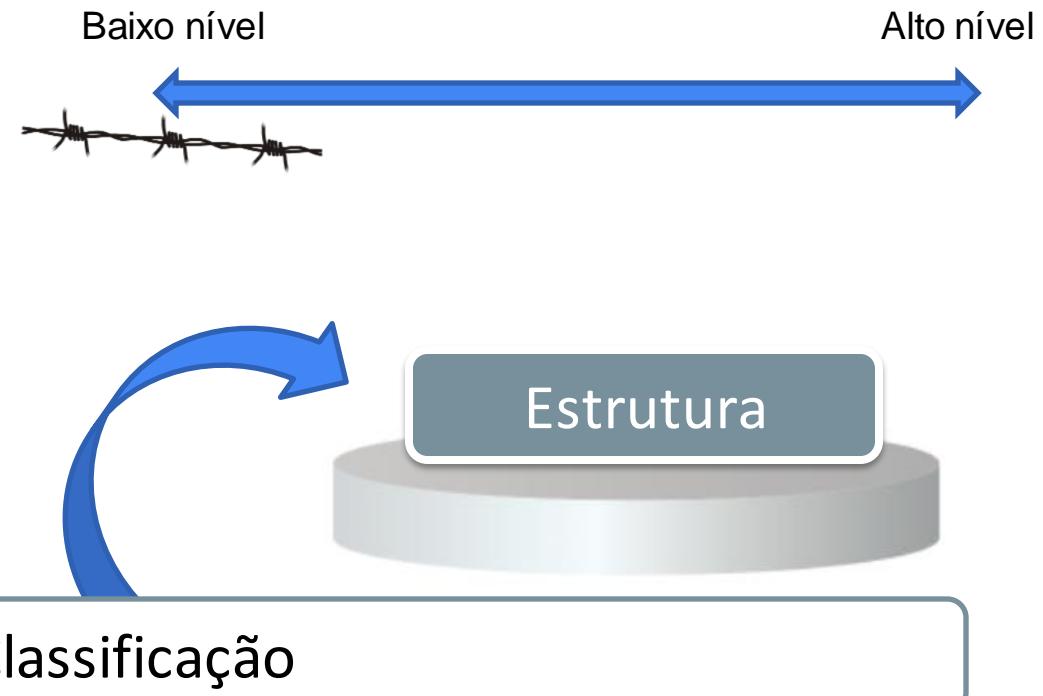
Classificação

Abstração

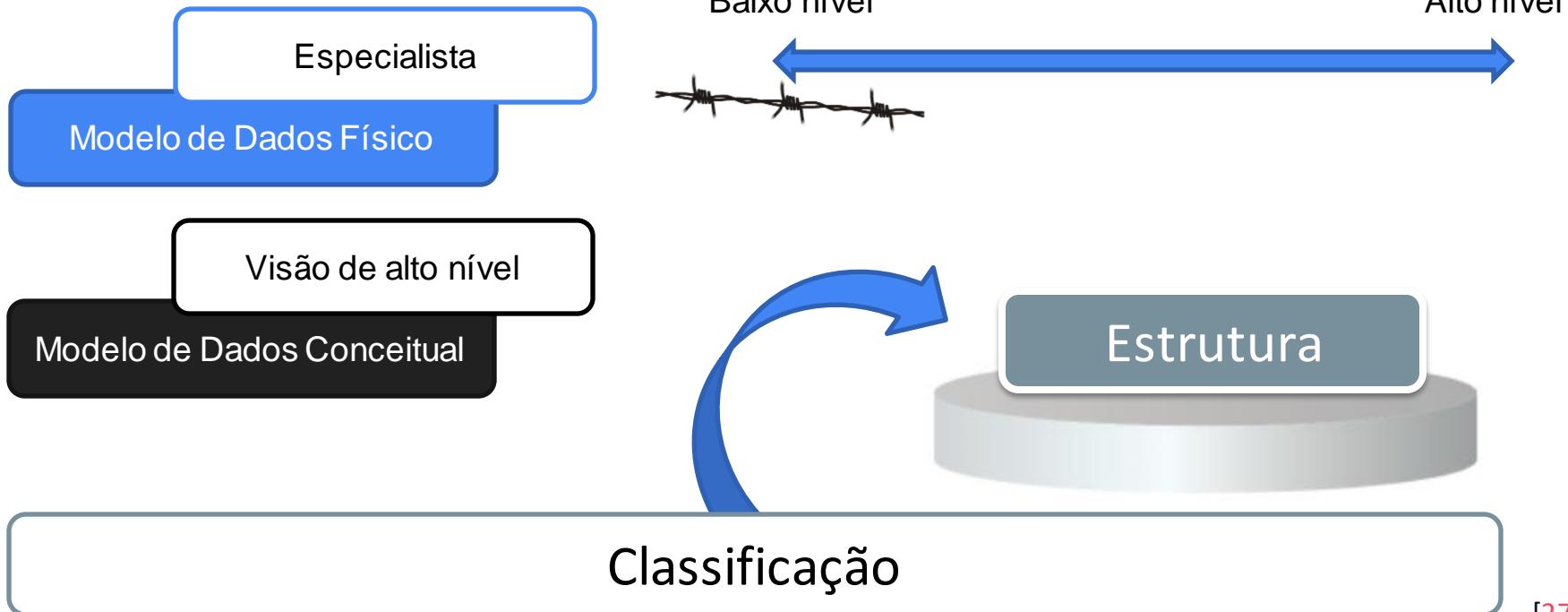


essencial

# Modelo



# Modelo



# Modelo

Especialista  
Modelo de Dados Físico

Visão de alto nível  
Modelo de Dados Conceitual

Classificação

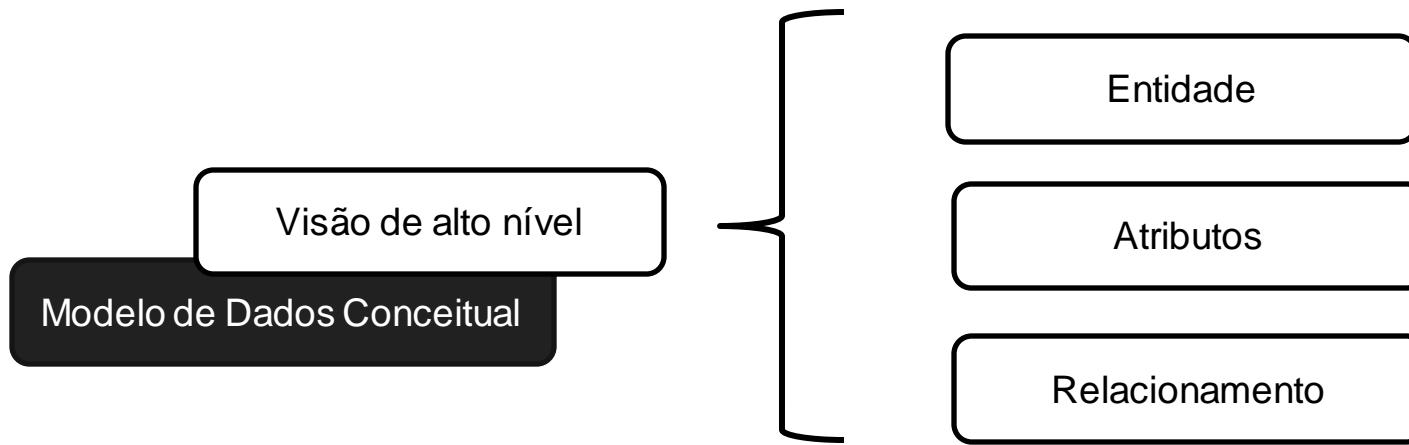


Representacional  
Modelo de Dados de implementação



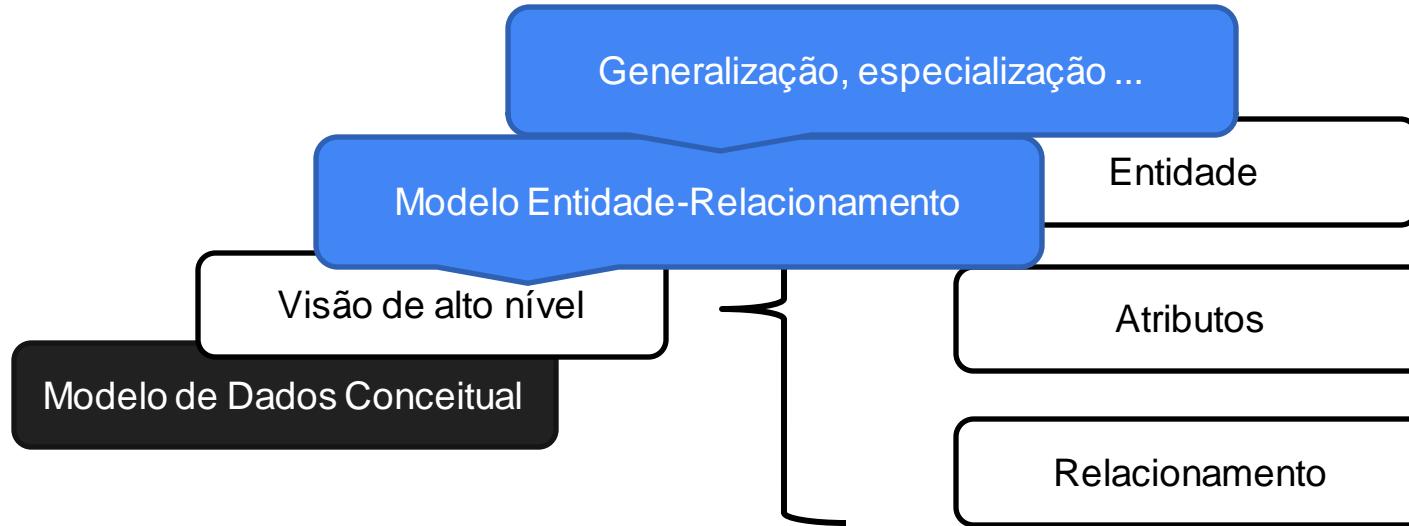
Estrutura

# Modelo



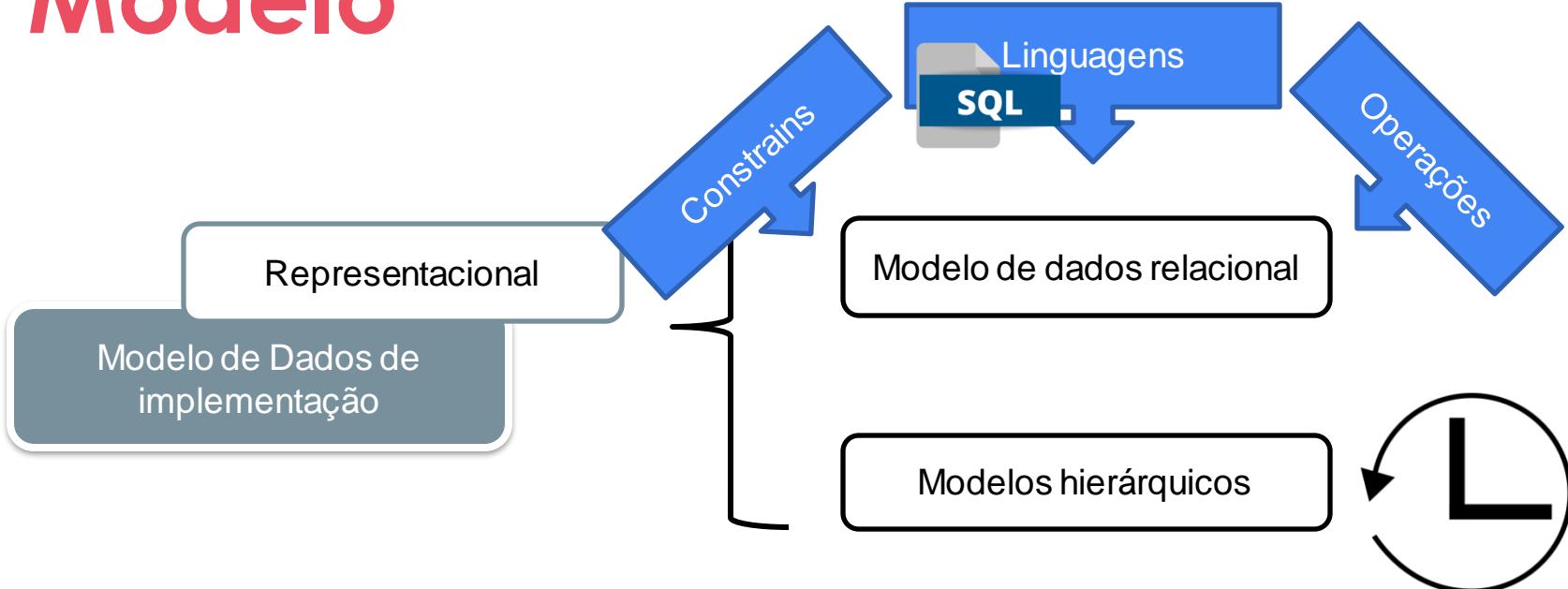
Classificação

# Modelo



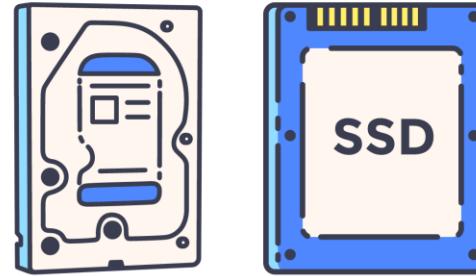
Classificação

# Modelo



Classificação

# Modelo



Modelo de Dados Físico

Especialista



.CSV

Classificação

# Modelo

Modelo de Dados  
Auto-descritivo



**XML**

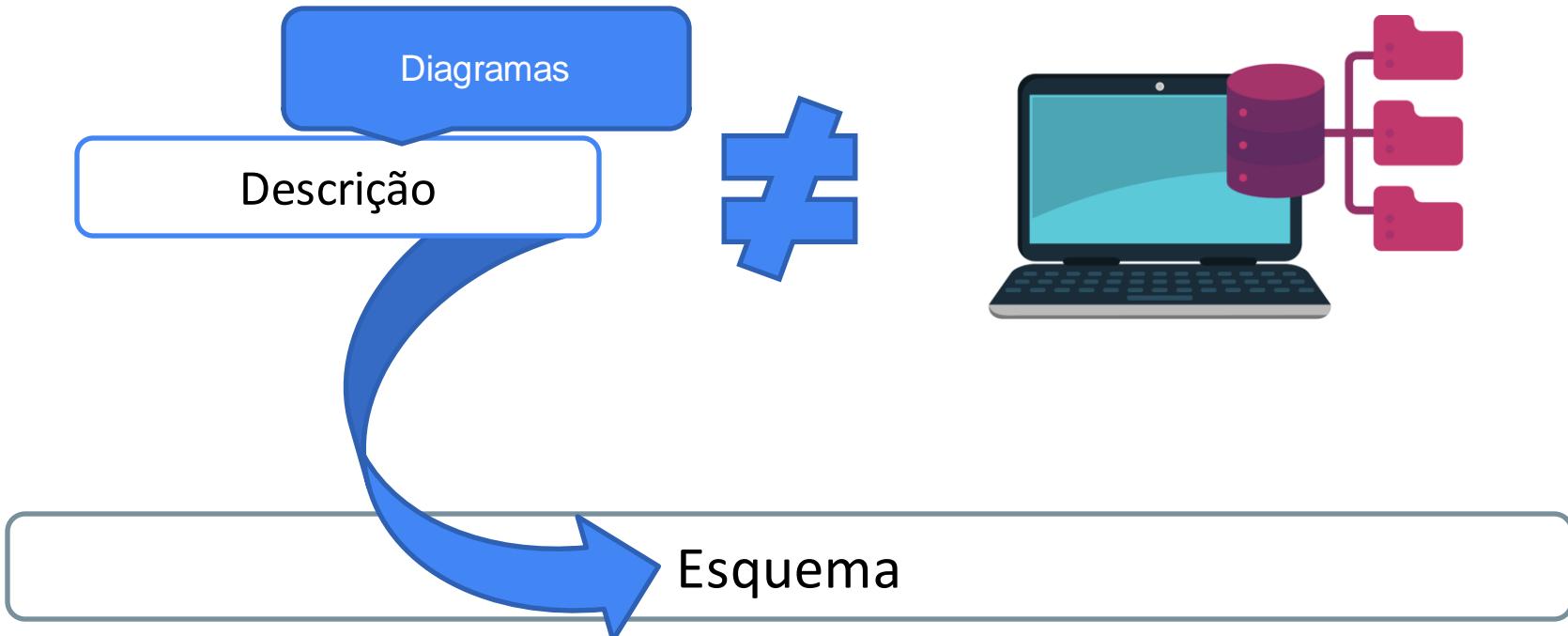
**KEY-VALUE**

Classificação

# Esquemas, Instâncias e Estados do BD



# Esquema



# Esquema

Diagrams

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

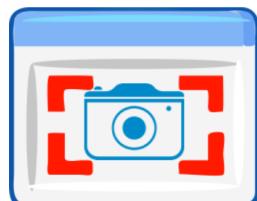
Section_identifier	Course_number	Semester	Year	Instructor
--------------------	---------------	----------	------	------------

## GRADE\_REPORT

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

Esquema

# Snapshot



Dados mudam

Instância | Ocorrência

Esquema

Insert, Delete

**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
--------------------	---------------	----------	------	------------

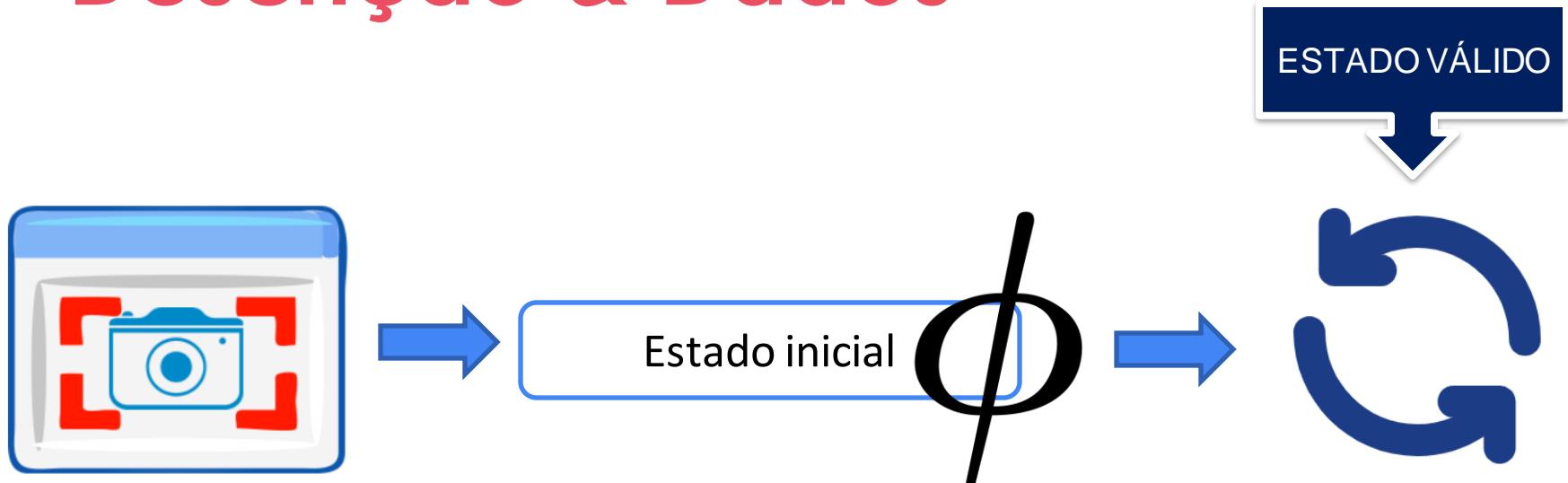
**GRADE\_REPORT**

Student_number	Score
----------------	-------

Mudança de estado

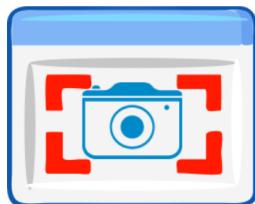
Update

# 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
--------------------	---------------	----------	------	------------

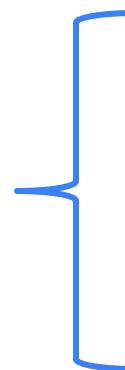
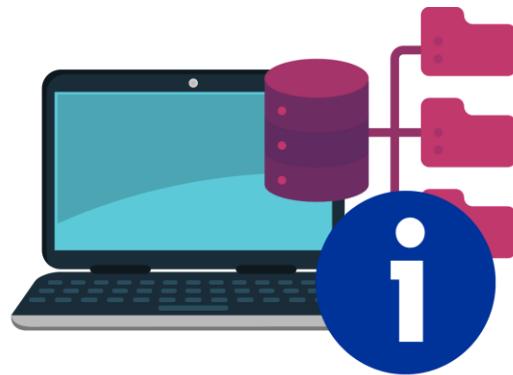
## GRADE\_REPORT

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

Instância | Ocorrência

Esquema

# Meta dados



Descrição esquema

Construtores

Constrains

Esquema

# Three-Schema Architecture



# Three-Schema

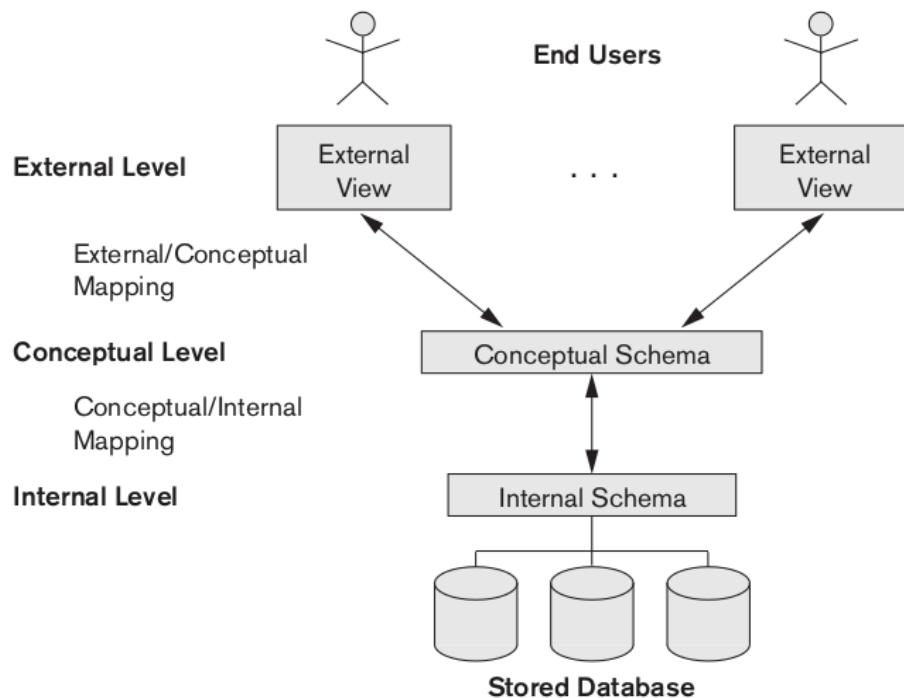
Catálogo

Isolamento  
data/program

Views

Esquema

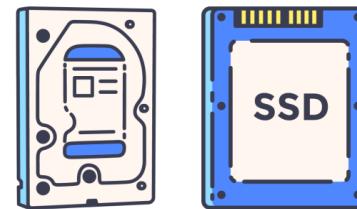
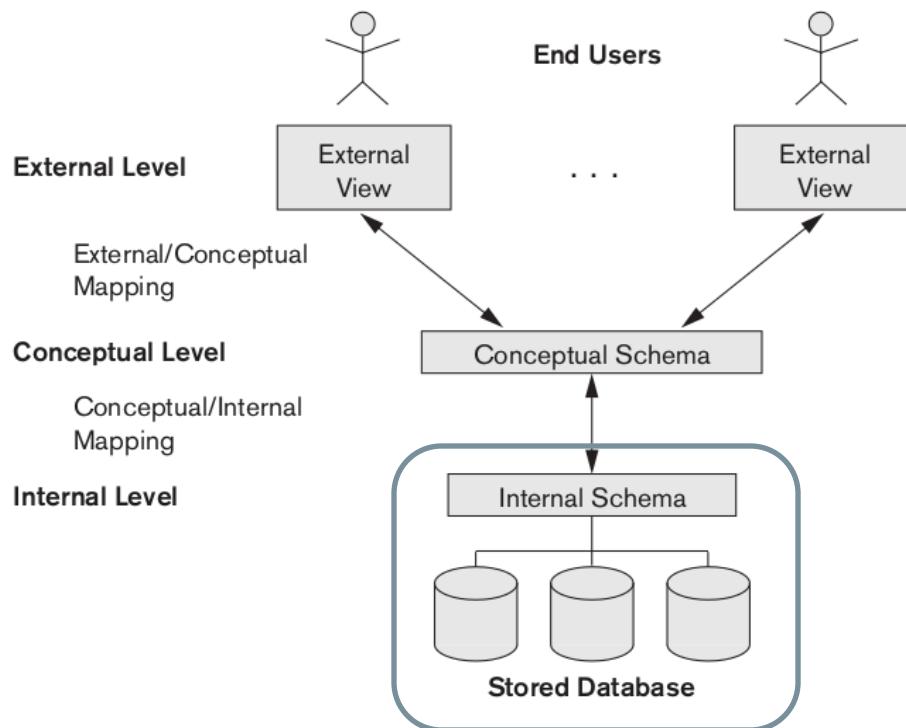
# Arquitetura



Aplicações de Usuário

Físico BD

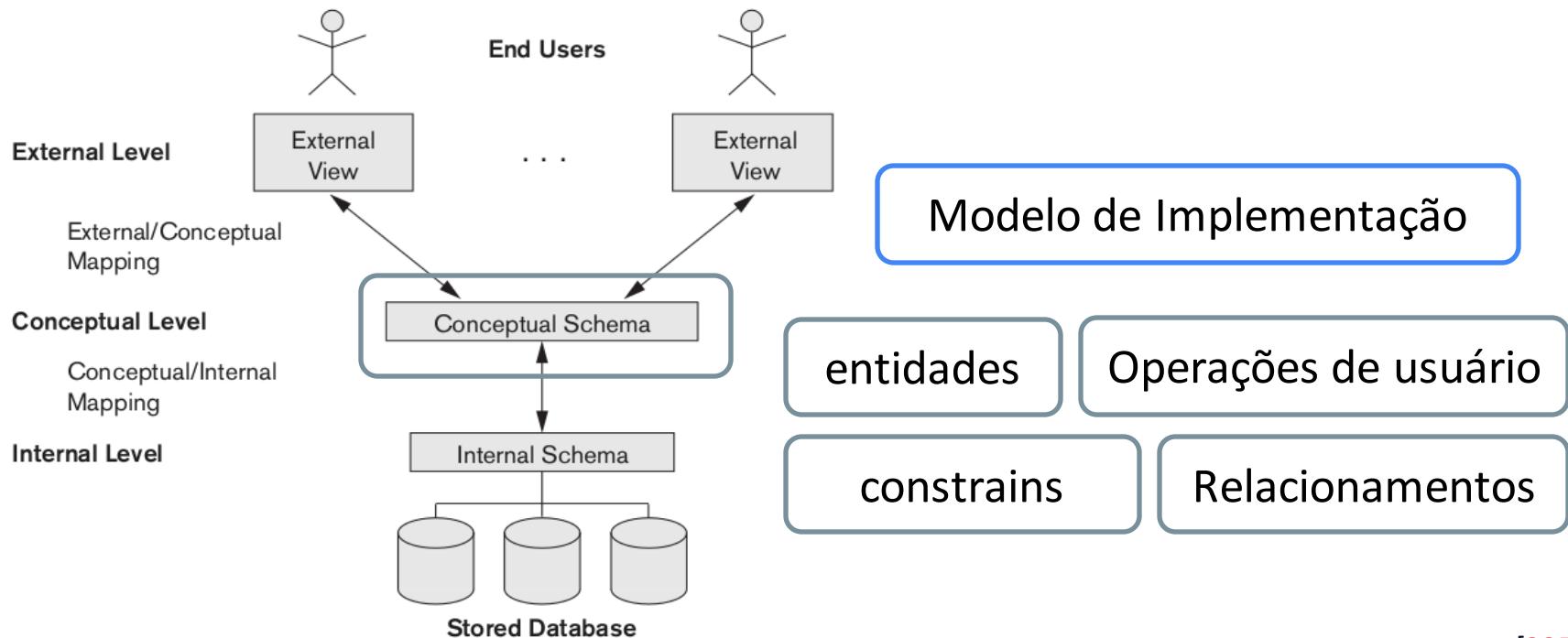
# Arquitetura



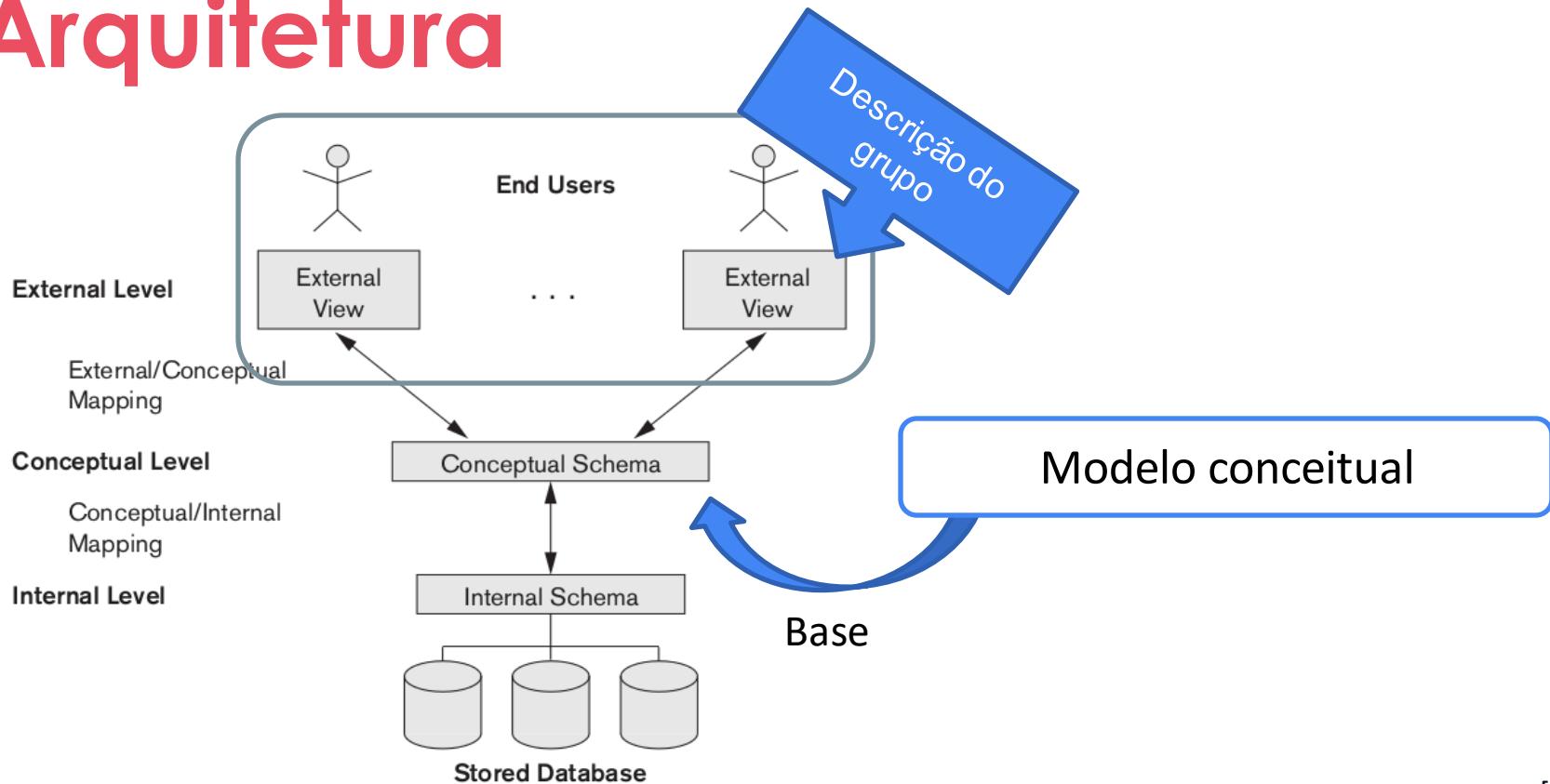
Modelo de dados físico



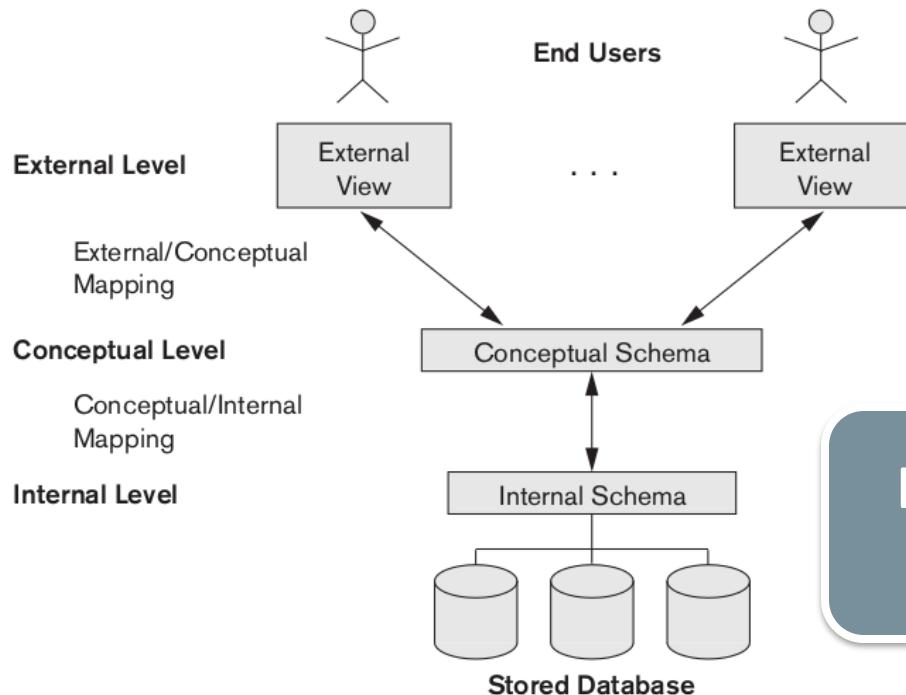
# Arquitetura



# Arquitetura



# Arquitetura



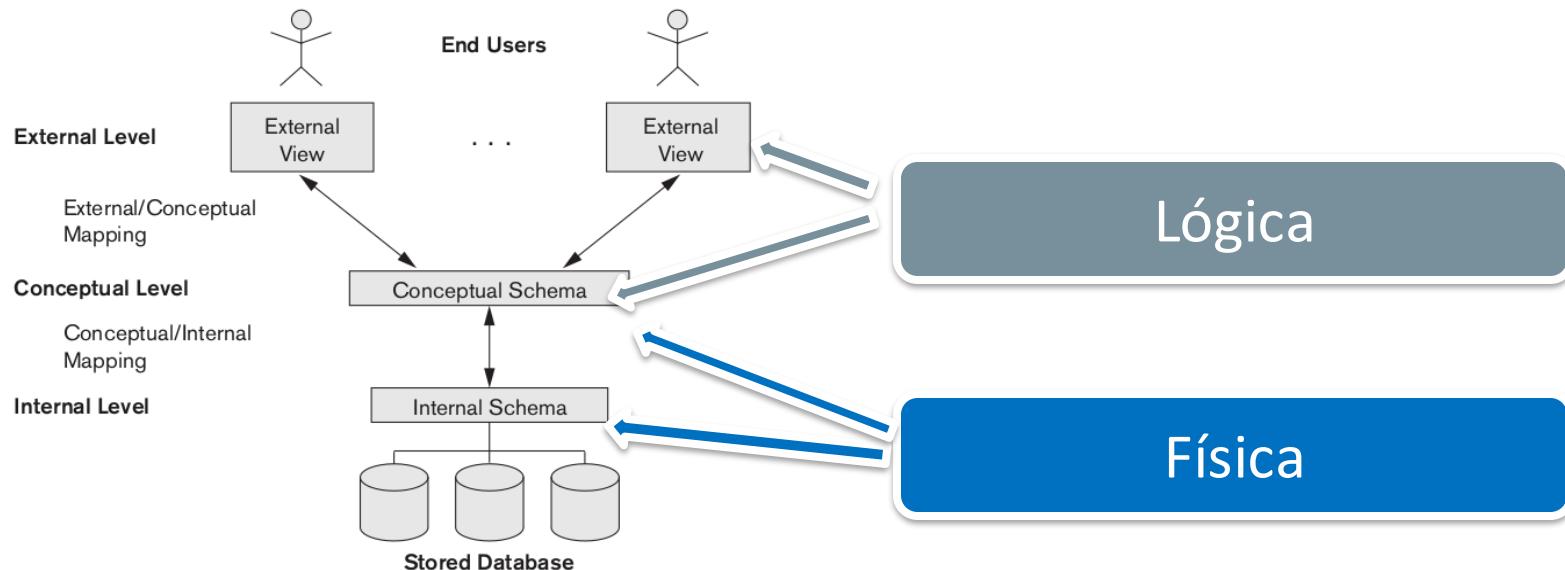
Explicitamente

NOT

Completamente

Desenvolvimento e Design  
do sistema

# Independência de dados

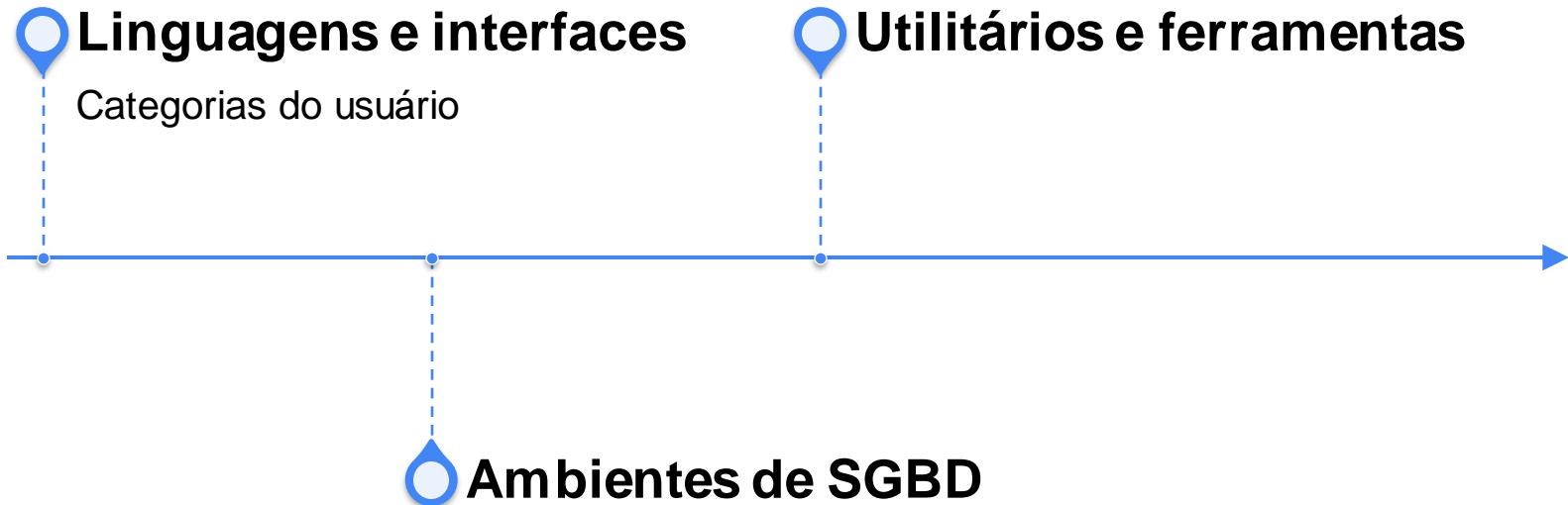


## Etapa 9

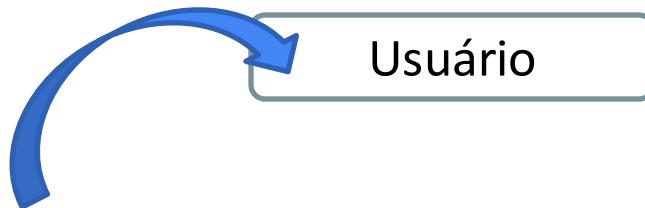
# Arquitetura: Linguagem, Interface e Ambiente de SGBDs

// Introdução à Banco de dados

# Conversa



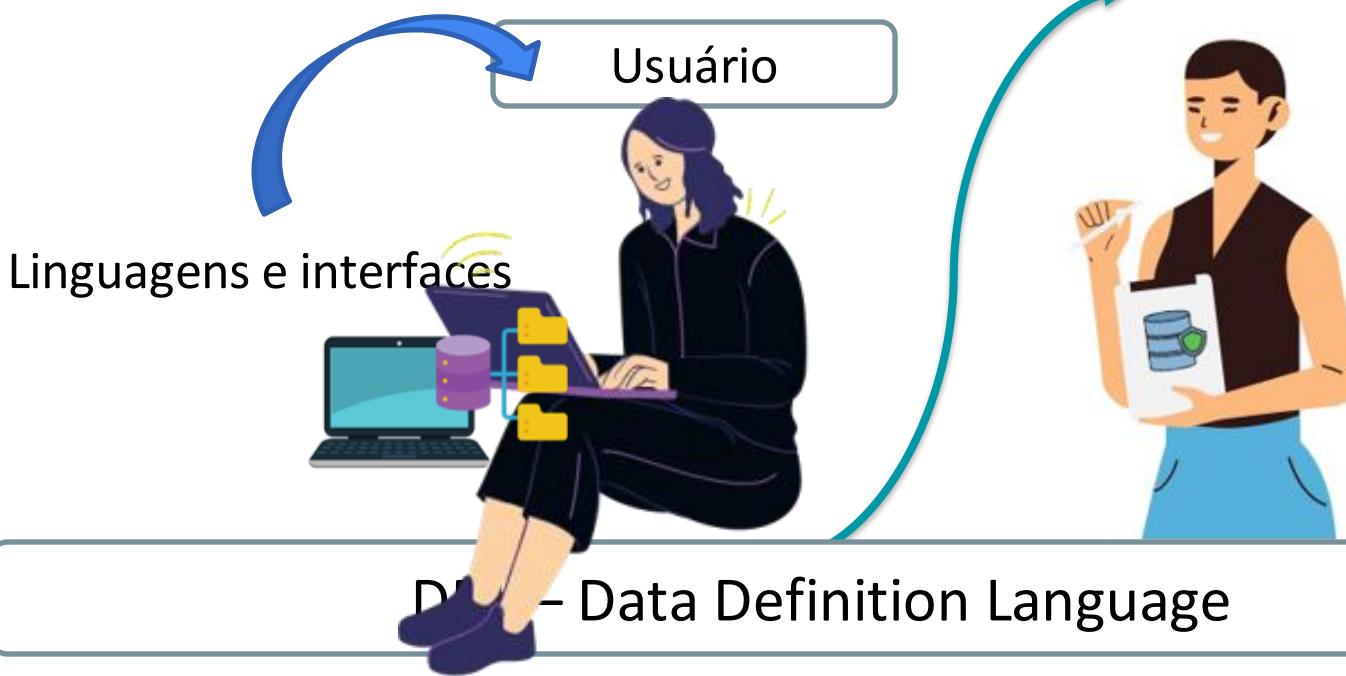
# Linguagens



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

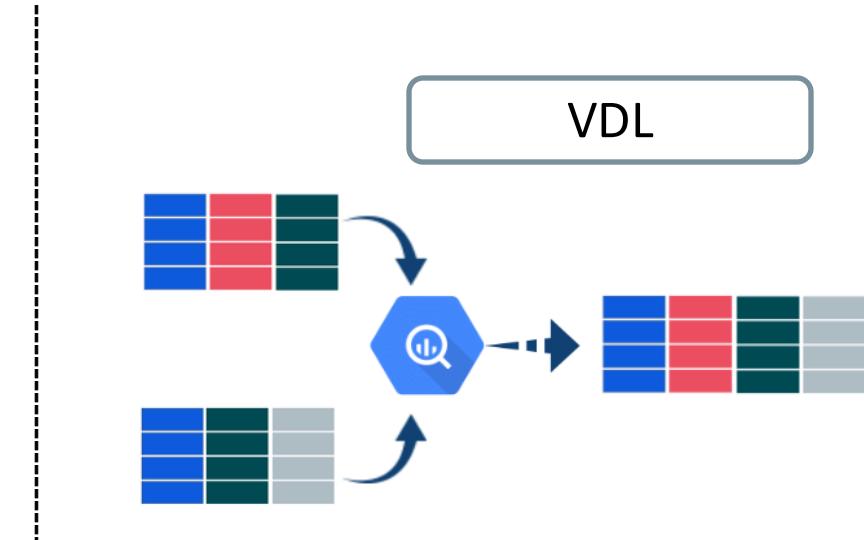
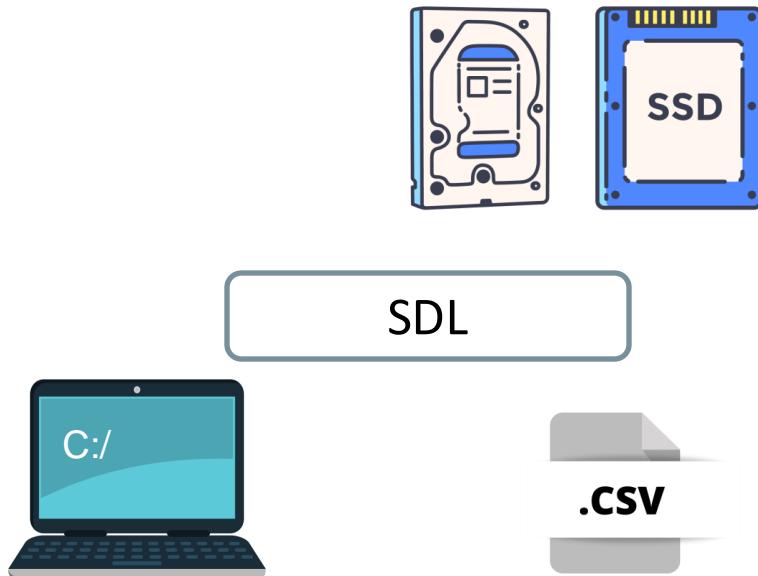
Section_identifier	Course_number	Semester	Year	Instructor
--------------------	---------------	----------	------	------------

## GRADE\_REPORT

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

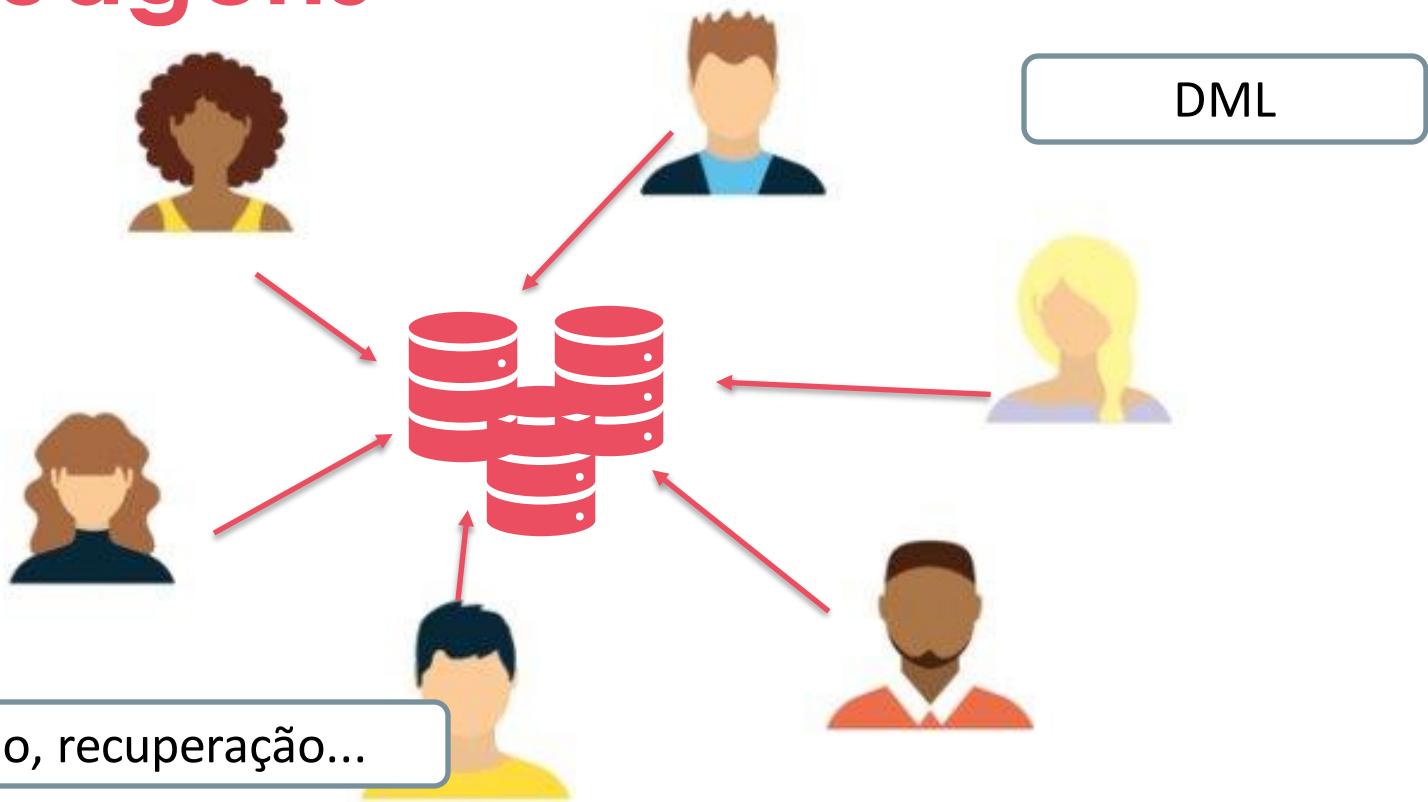


# Linguagens

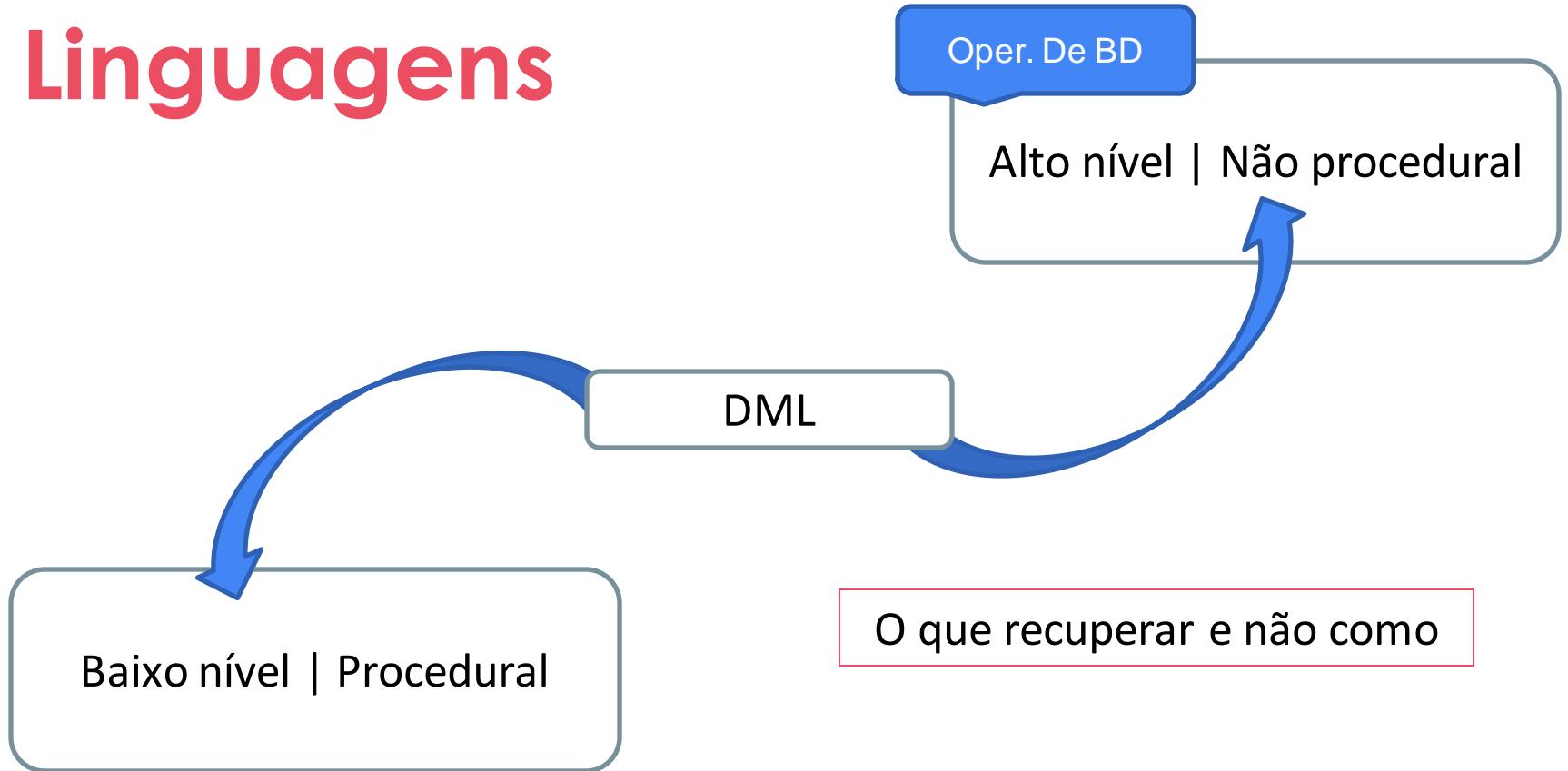


Separação explícita

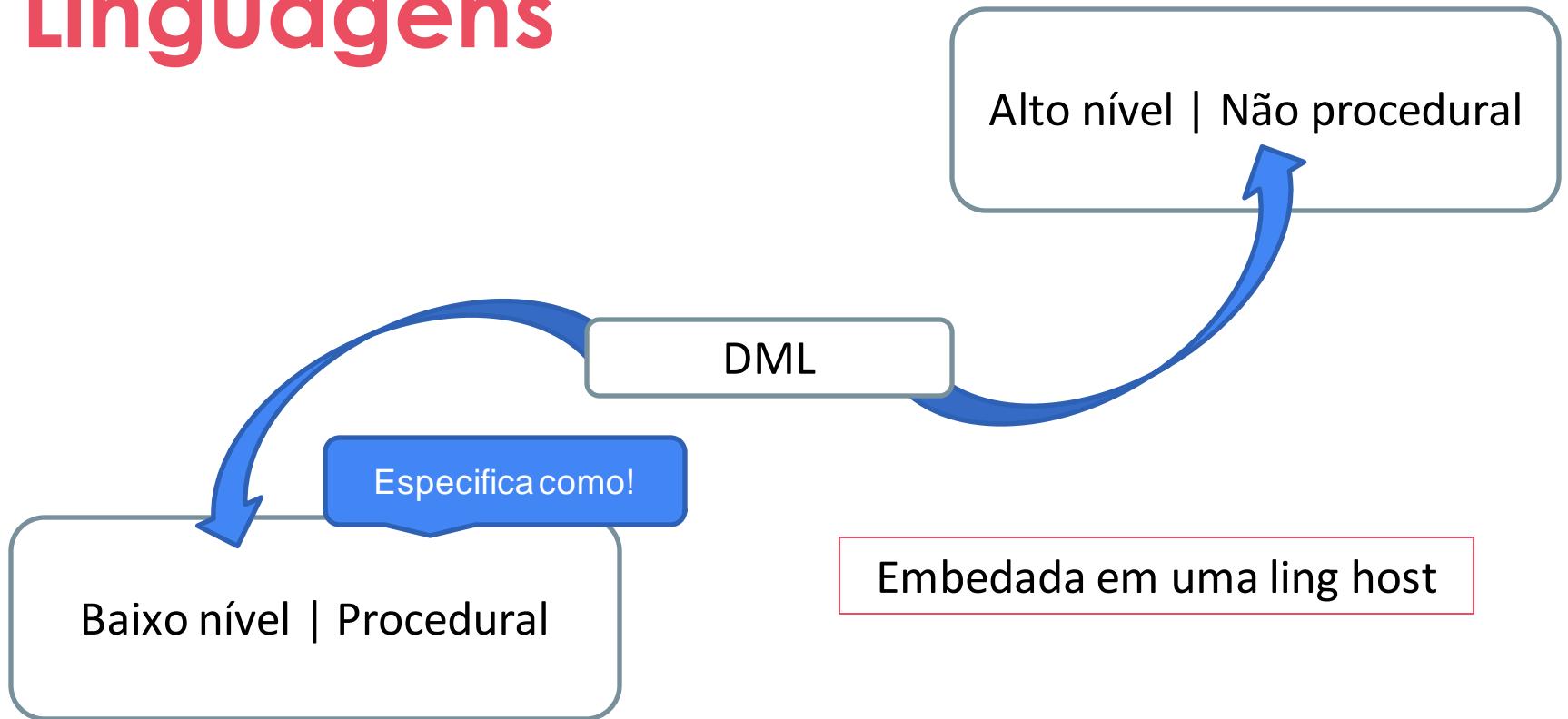
# Linguagens



# Linguagens



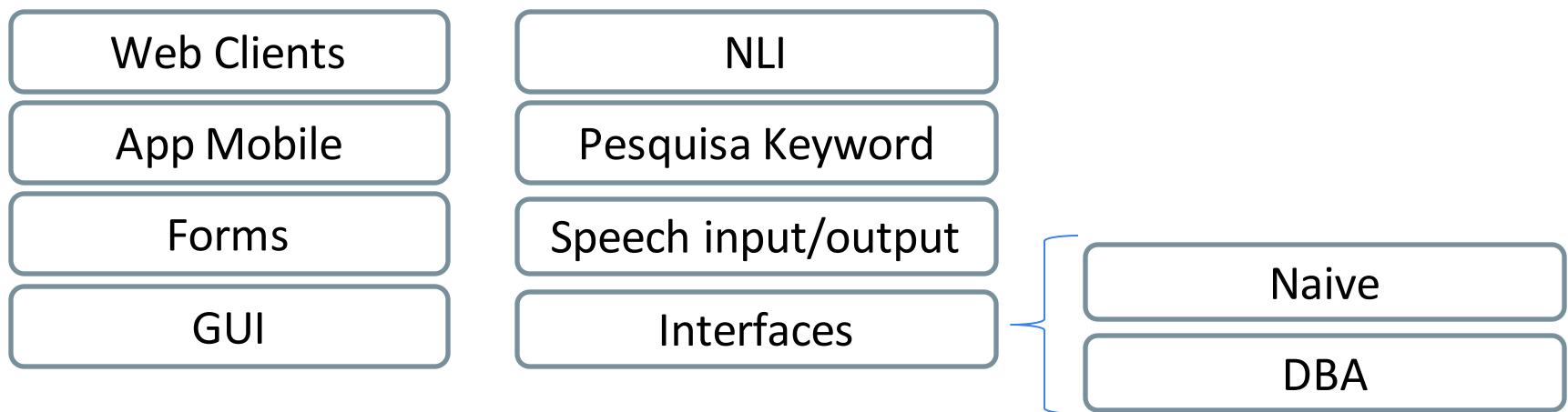
# Linguagens



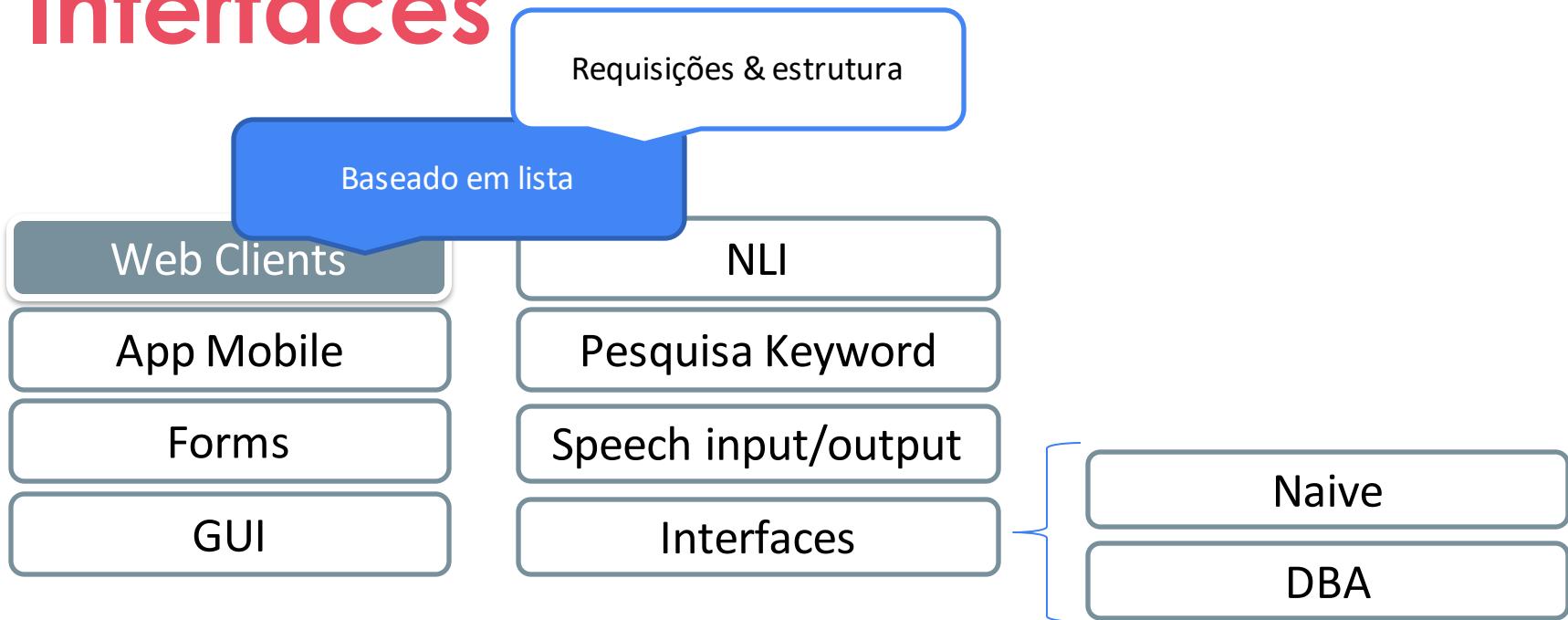
# Interfaces



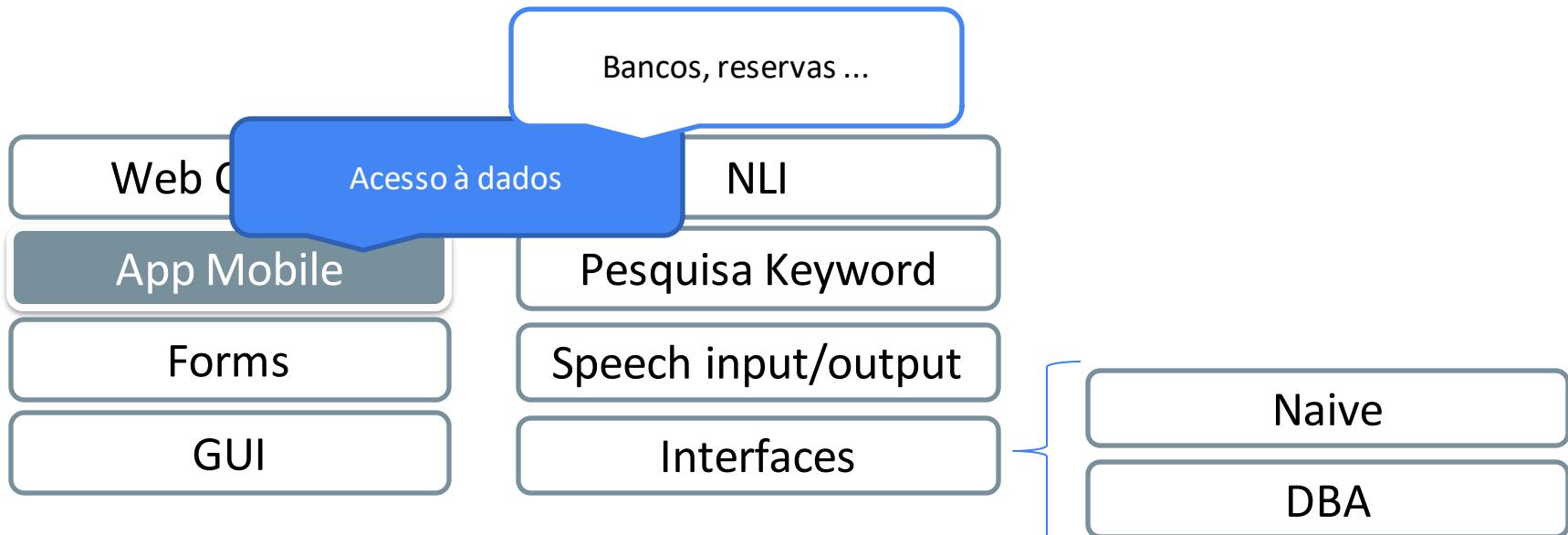
# Interfaces



# Interfaces

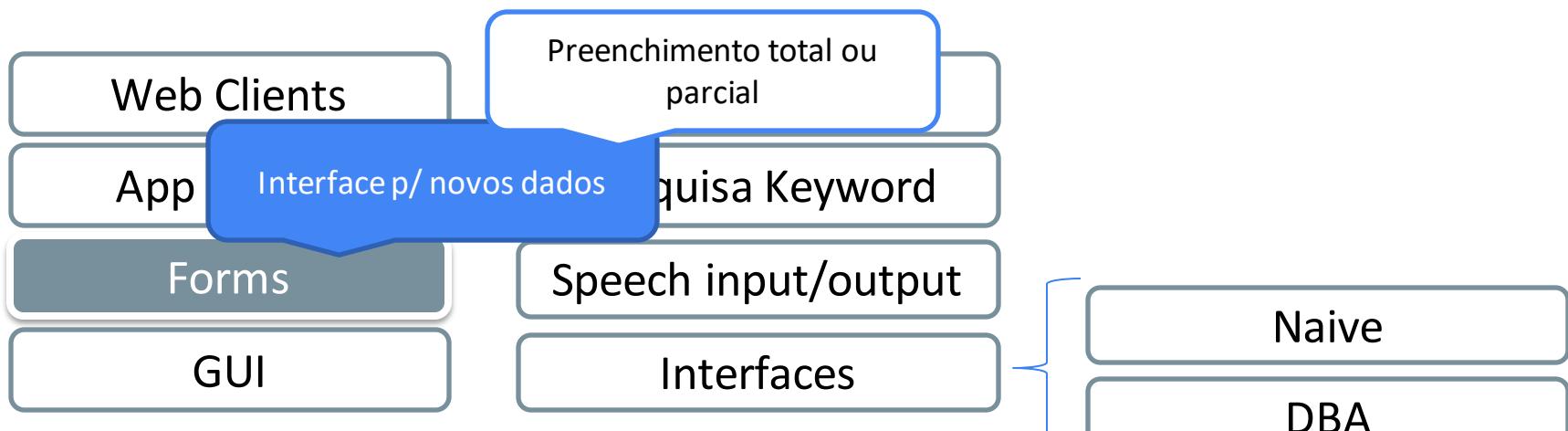


# Interfaces



Menu limitado pelo app

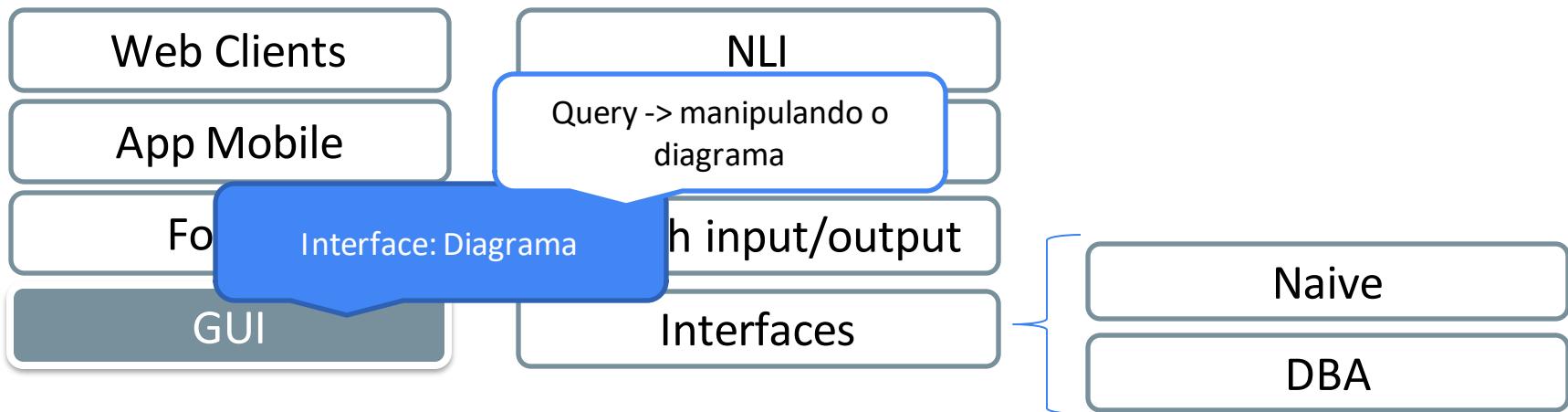
# Interfaces



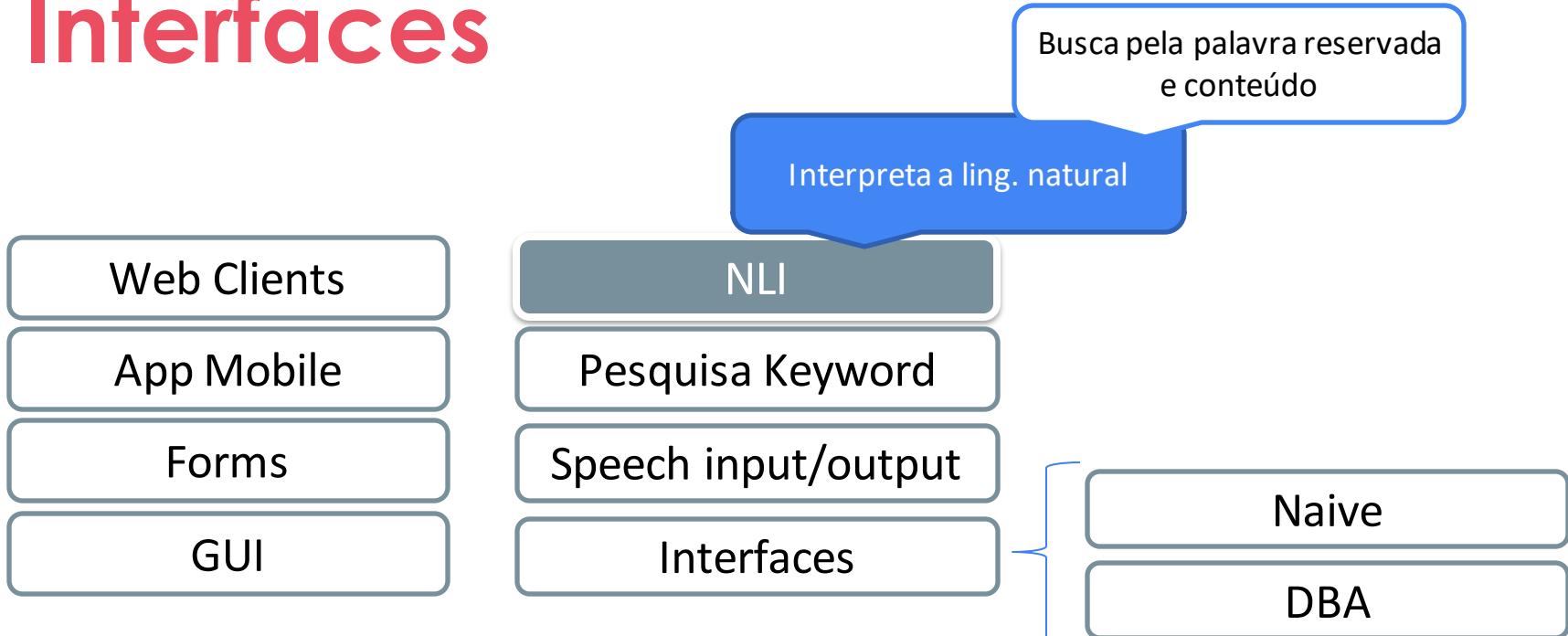
Voltados para Naive com transações canned

SQL\*Forms

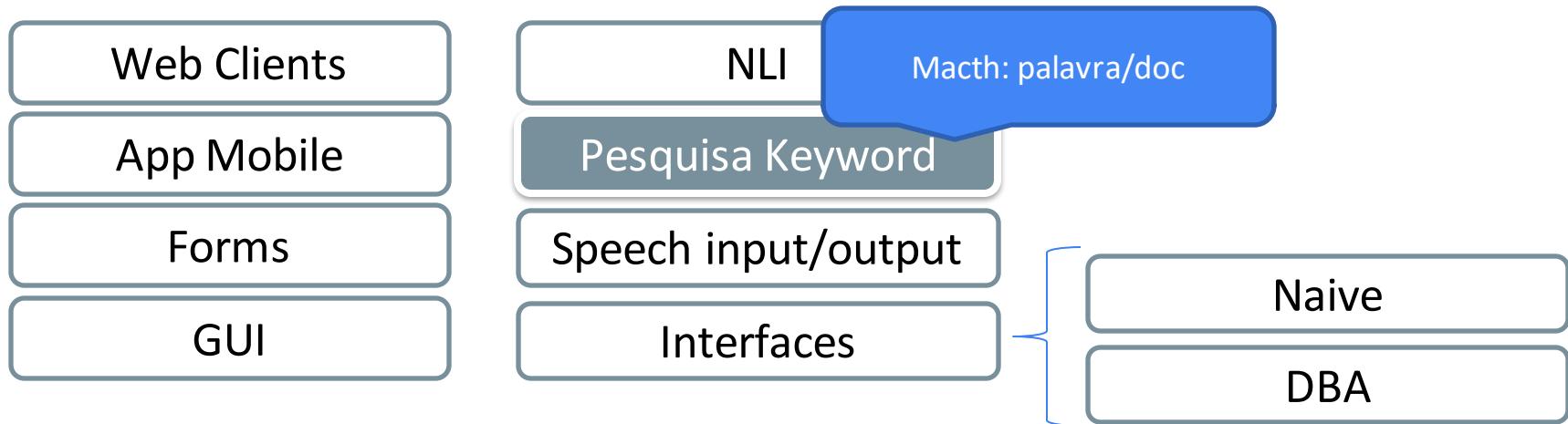
# Interfaces



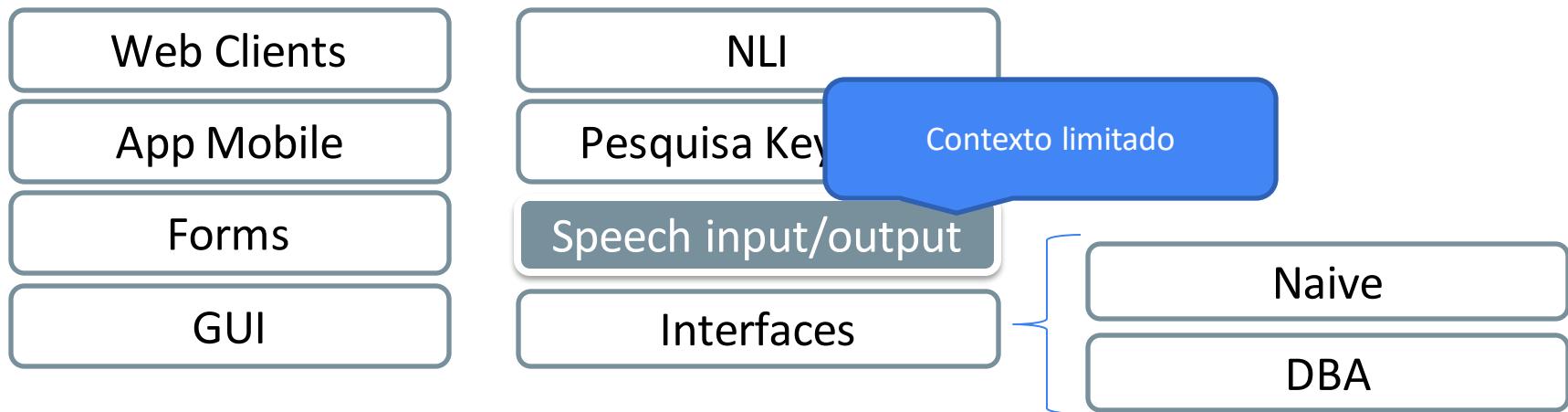
# Interfaces



# Interfaces

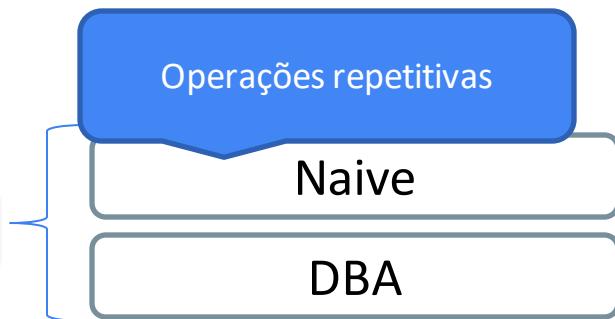
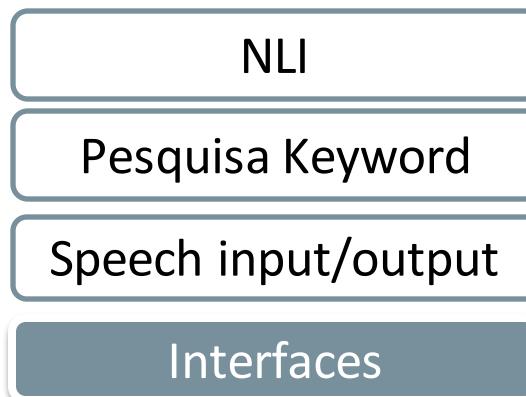


# Interfaces



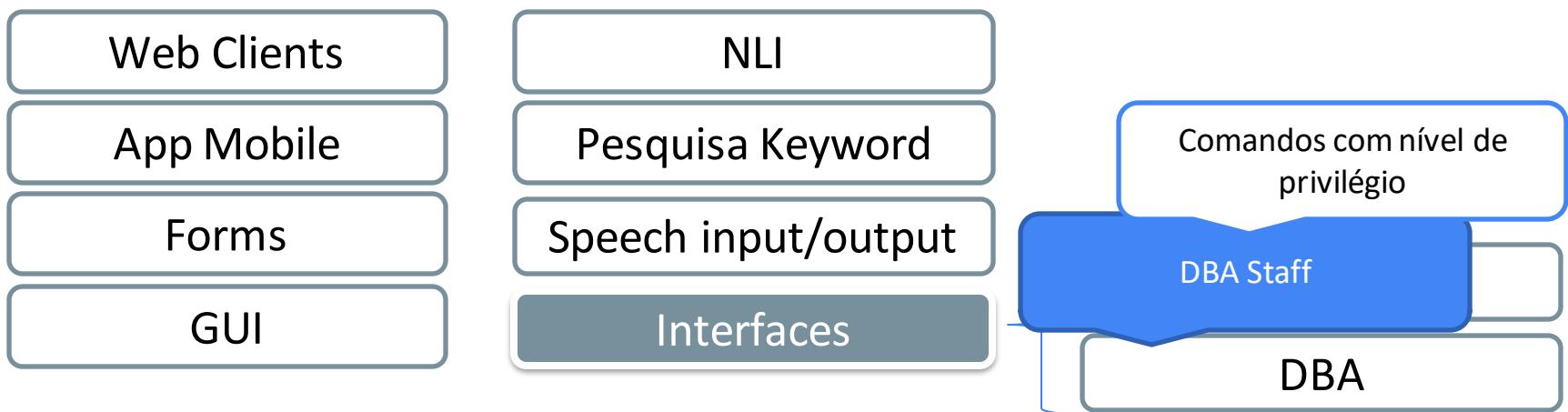
Speech como input e resposta

# Interfaces



Transações de rotina e repetitivas - saldo do banco

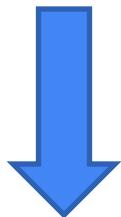
# Interfaces



# Ambiente



# Componentes



Software



Modularizado

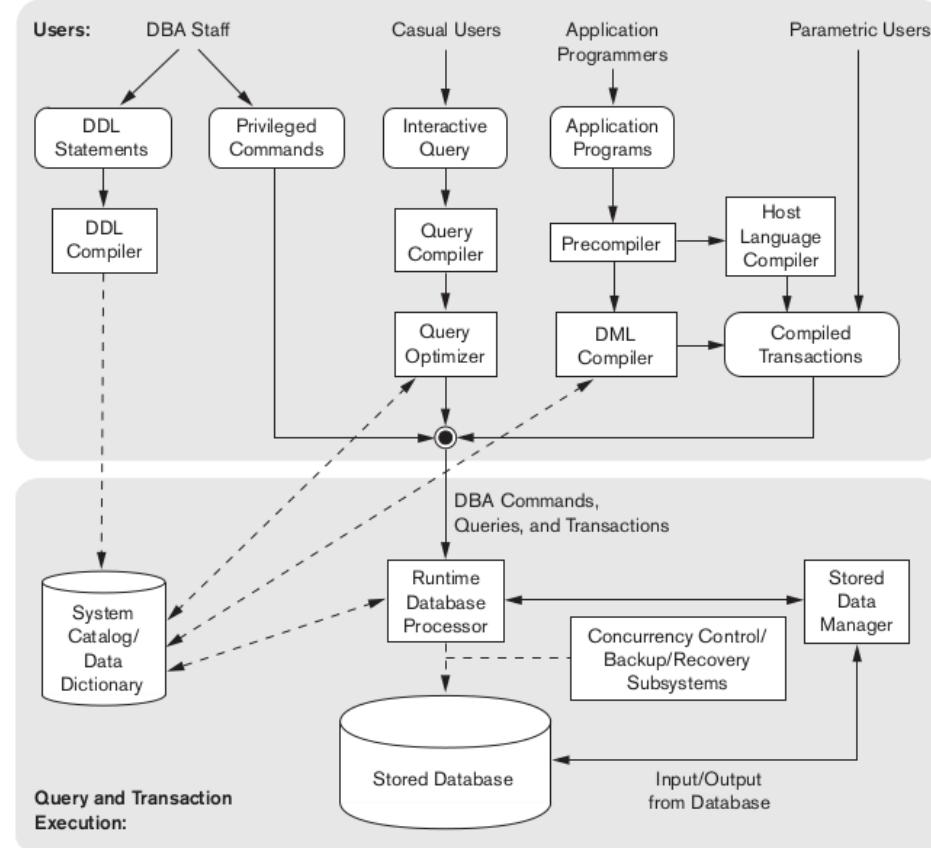


Figure 2.3

Component modules of a DBMS and their interactions.

# Componentes

Ambiente de BD

Módulos internos

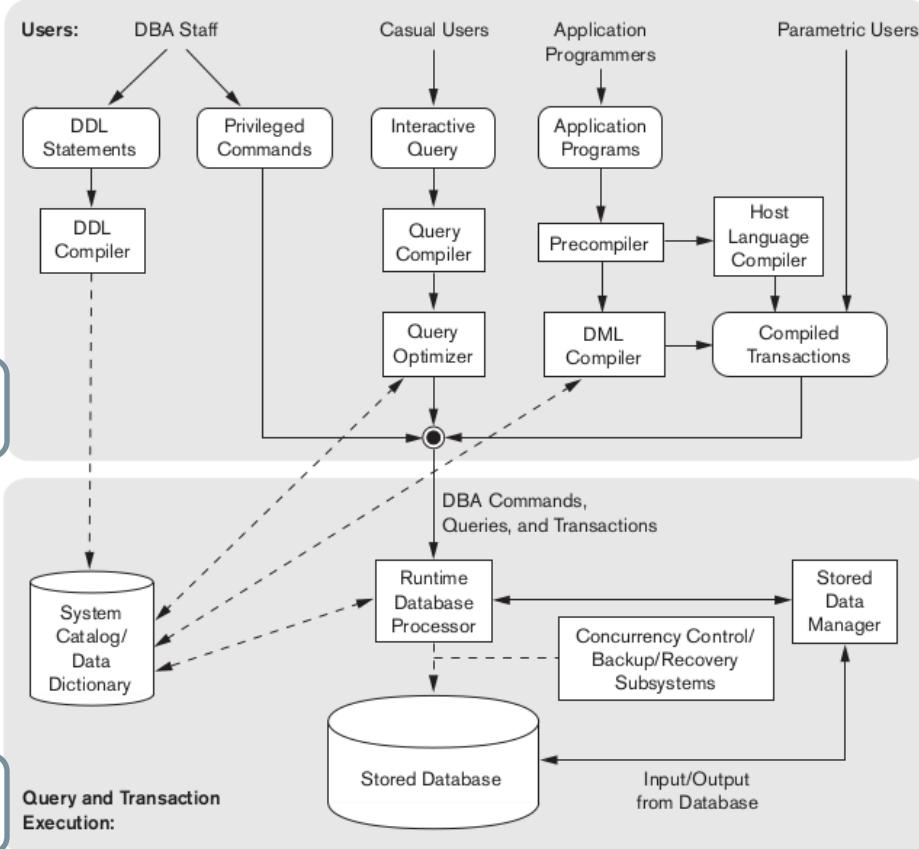


Figure 2.3

Component modules of a DBMS and their interactions.

# Componentes

Esquema

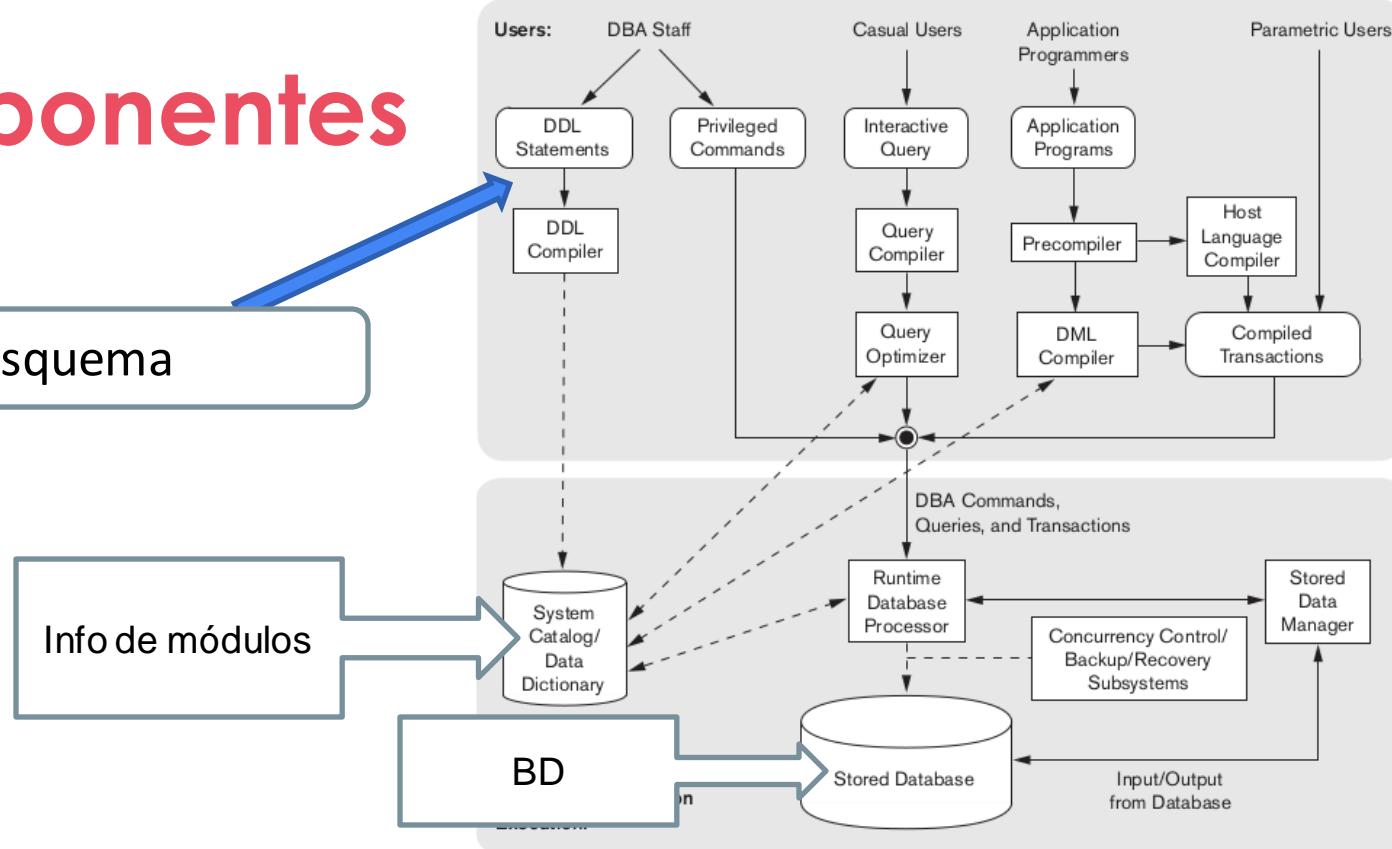


Figure 2.3

Component modules of a DBMS and their interactions.

# Componentes

Acesso ocasional

Ex: Reordenação de operações

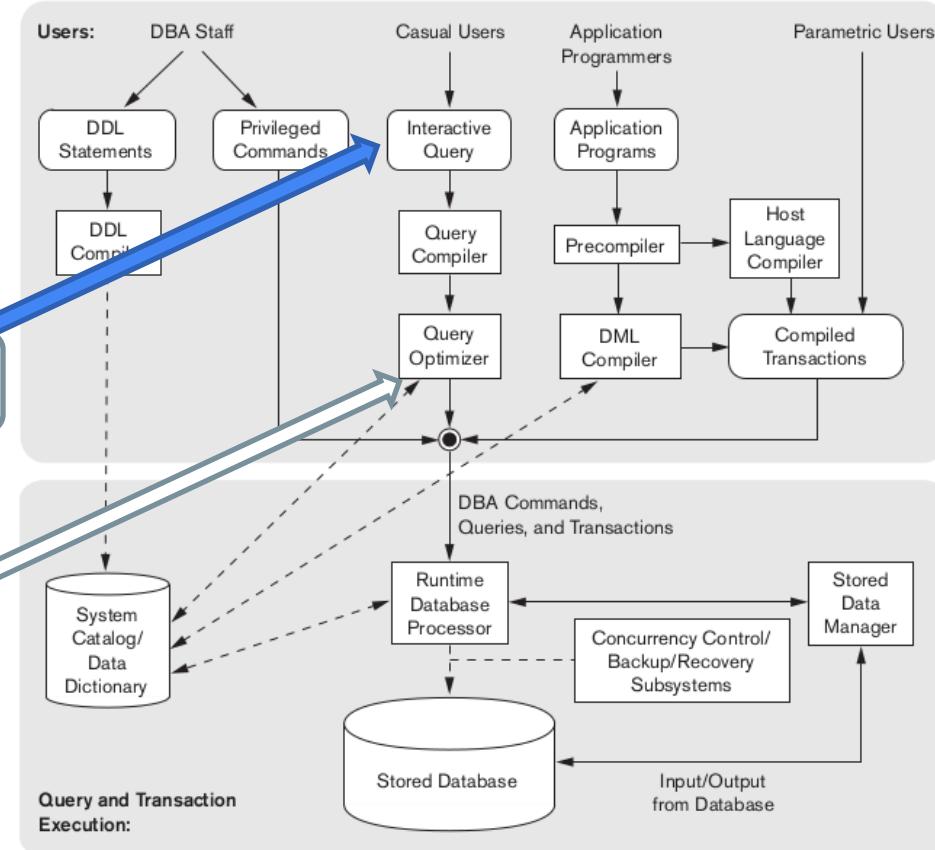


Figure 2.3

Component modules of a DBMS and their interactions.

# Componentes

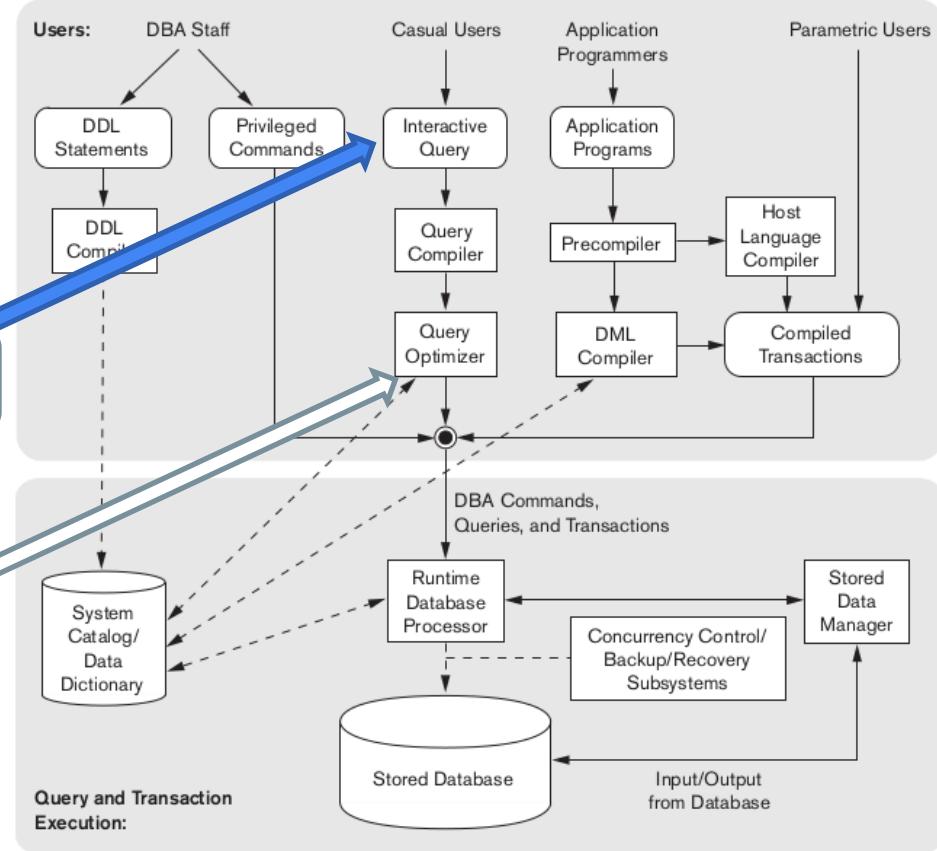
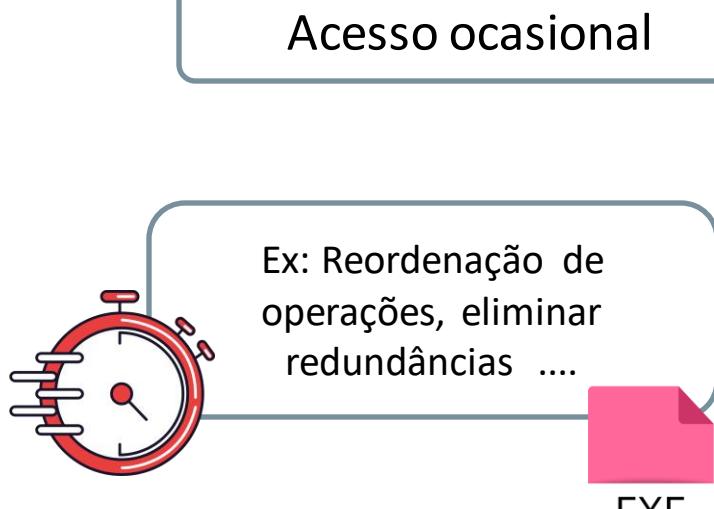


Figure 2.3  
Component modules of a DBMS and their interactions.

# Componentes



Linguagens de prog.

Extrai DML

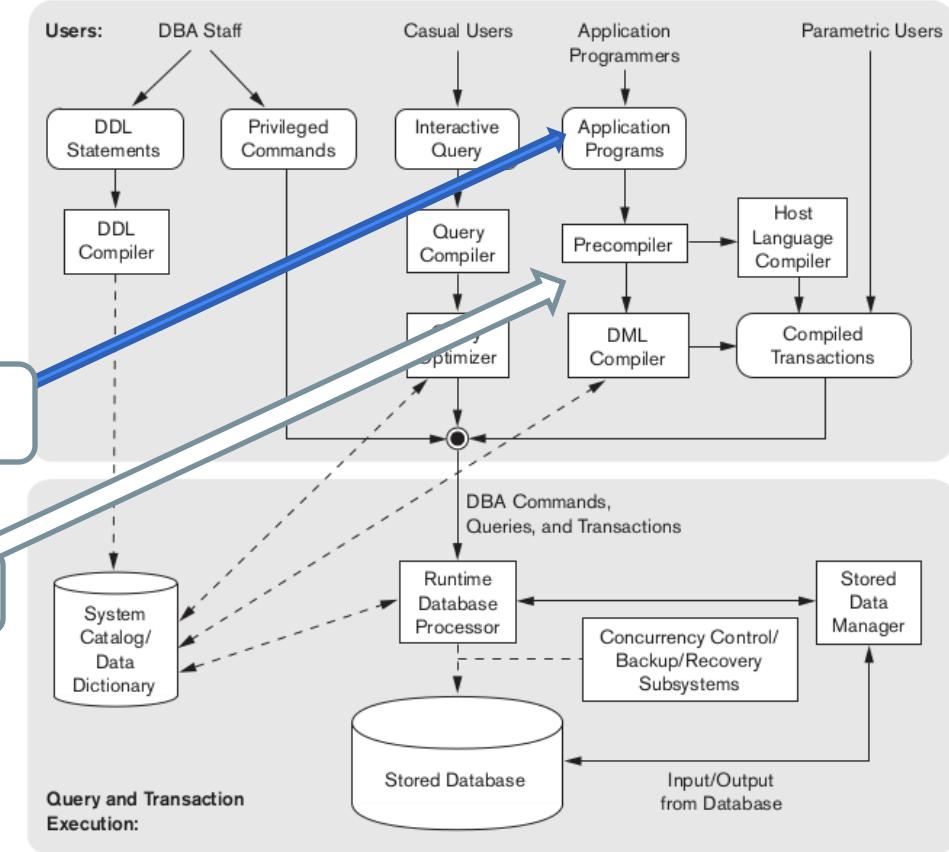


Figure 2.3

Component modules of a DBMS and their interactions.

# Componentes

Canned Transaction

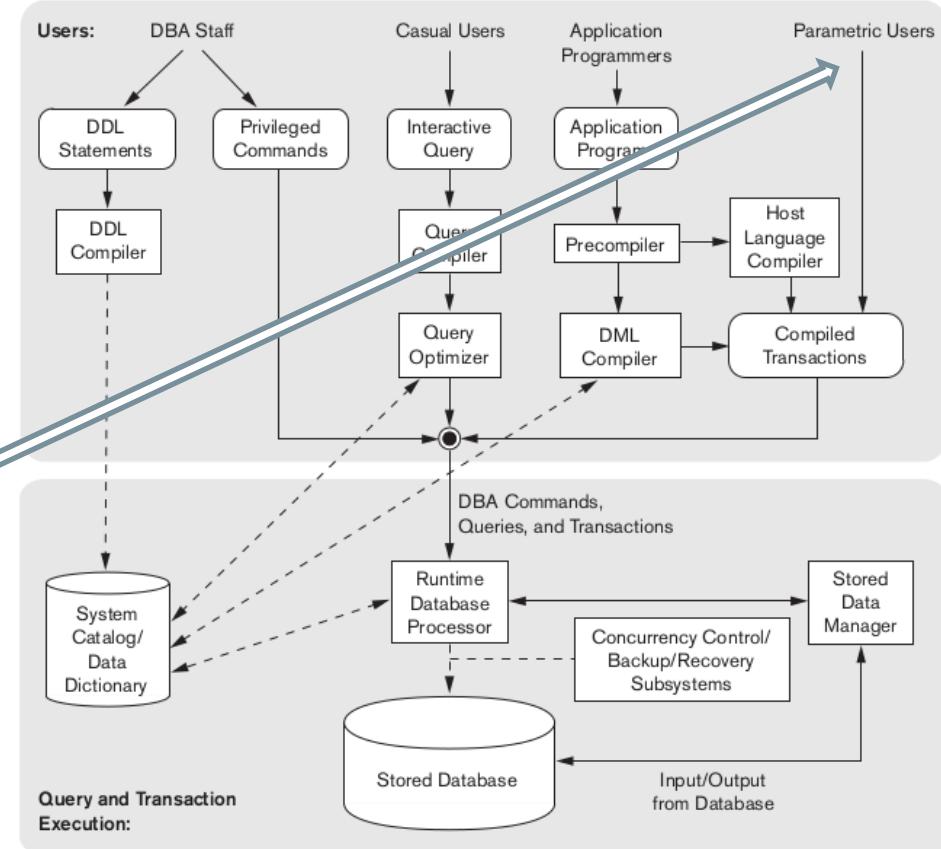


Figure 2.3

Component modules of a DBMS and their interactions.

# Componentes

Privileged commands,  
Query plans,  
Canned transactions ...

Infos de hd/ram

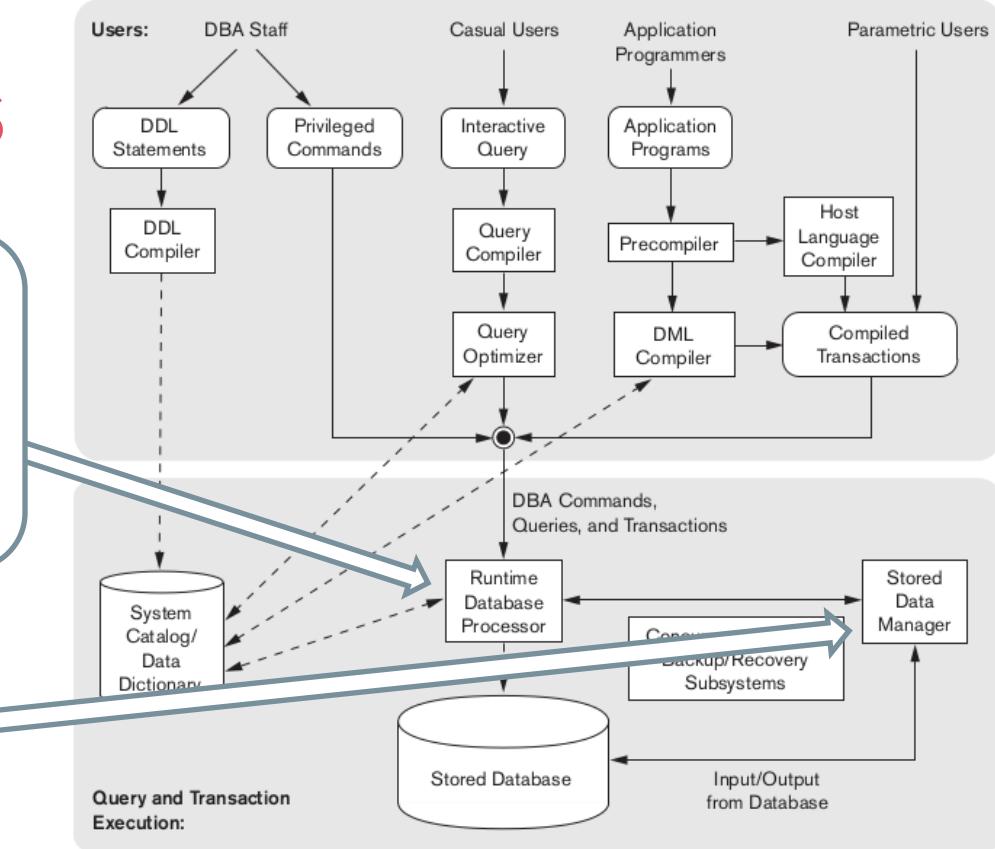


Figure 2.3

Component modules of a DBMS and their interactions.

# Componentes

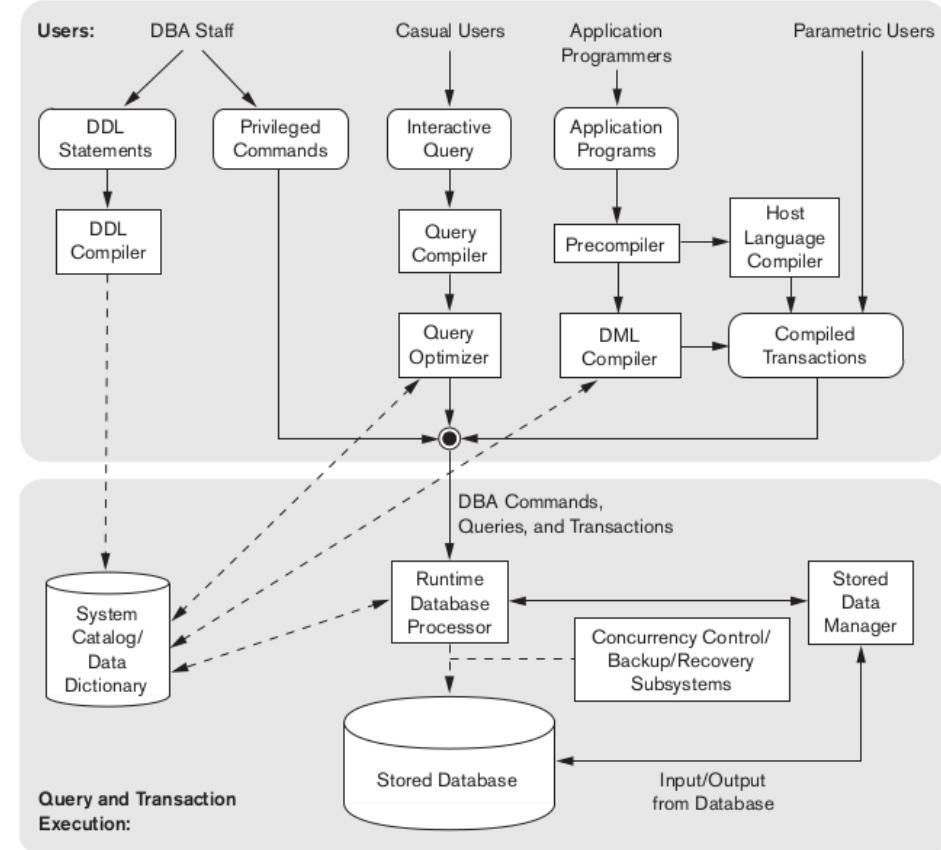
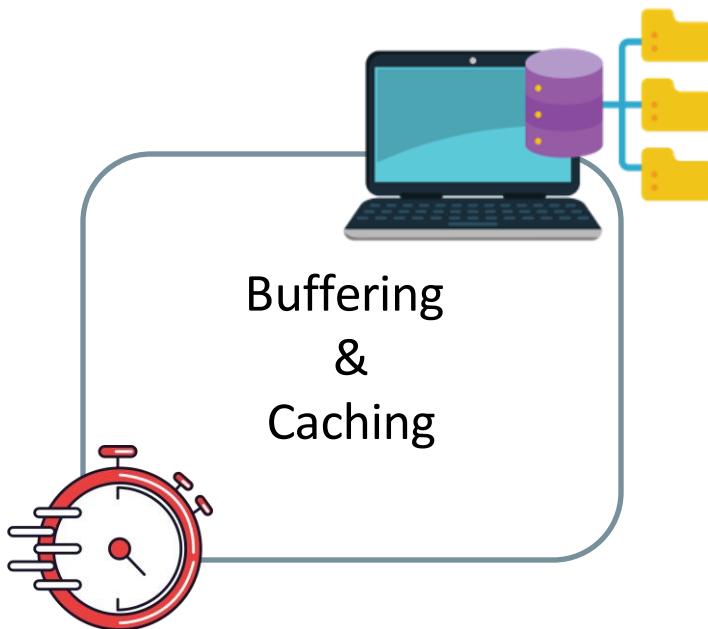
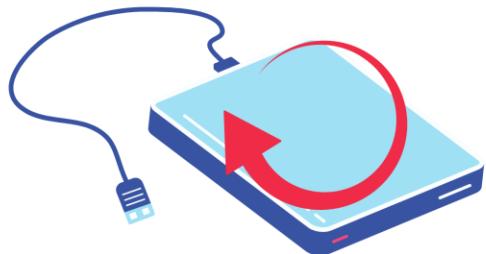


Figure 2.3

Component modules of a DBMS and their interactions.

# Utilities – Gerenciamento



Monitoramento

Reorganização do storage

Backup

Loading

Reformatar os dados



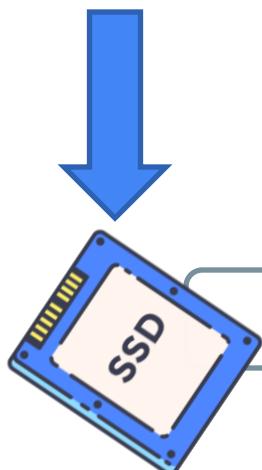
# Utilities – Gerenciamento



Monitoramento

Reorganização do storage

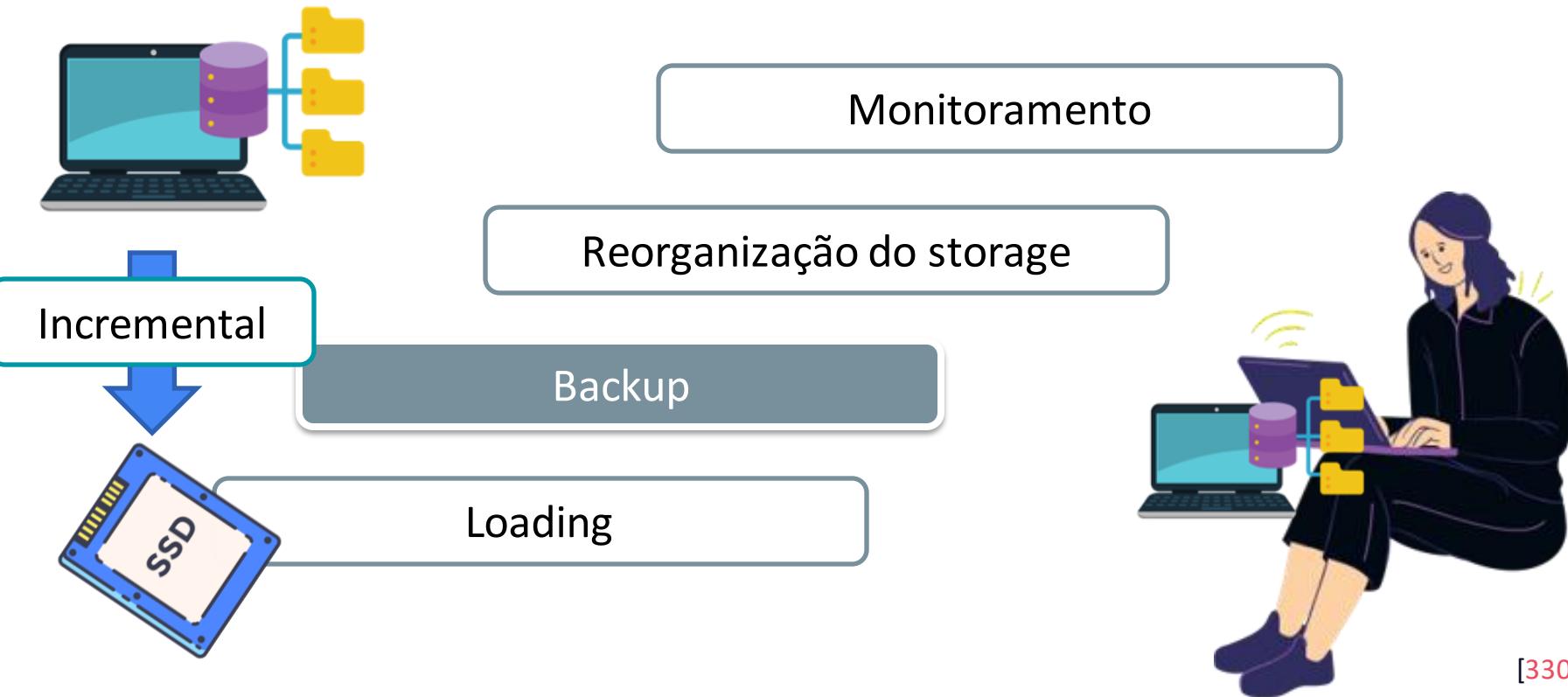
Backup



Loading



# Utilities – Gerenciamento



# Utilities – Gerenciamento



Monitoramento

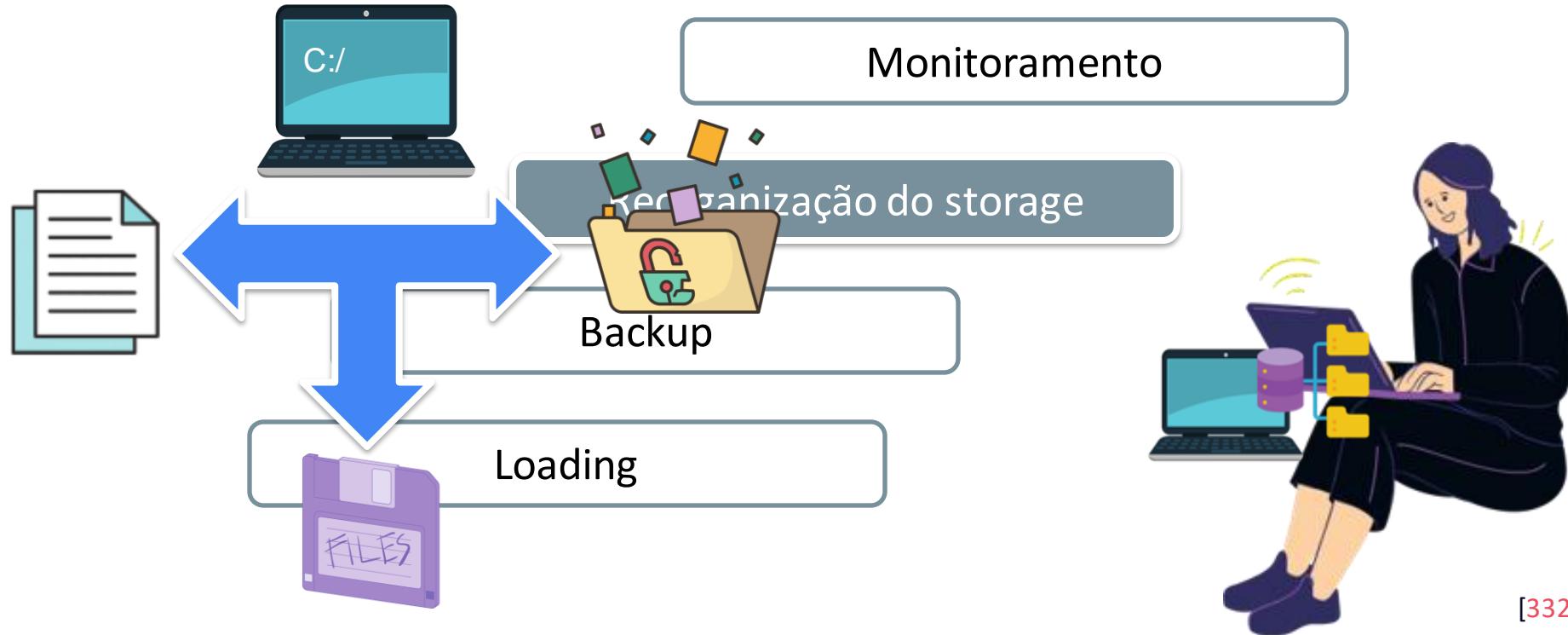
Reorganização do storage

Backup

Loading



# Utilities – Gerenciamento



# Utilities – Gerenciamento



Monitoramento

Reorganização do storage

Backup

Loading

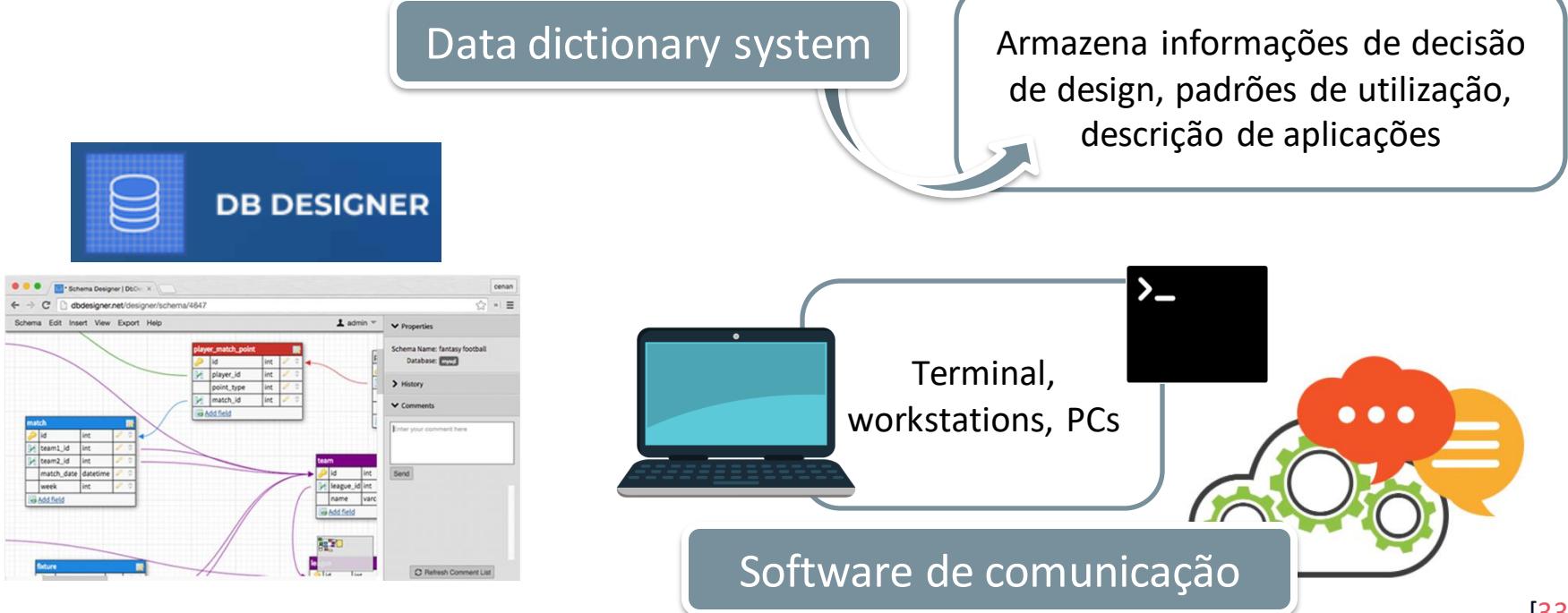
Estatísticas do BD



Decisões



# Ferramentas e aplicações

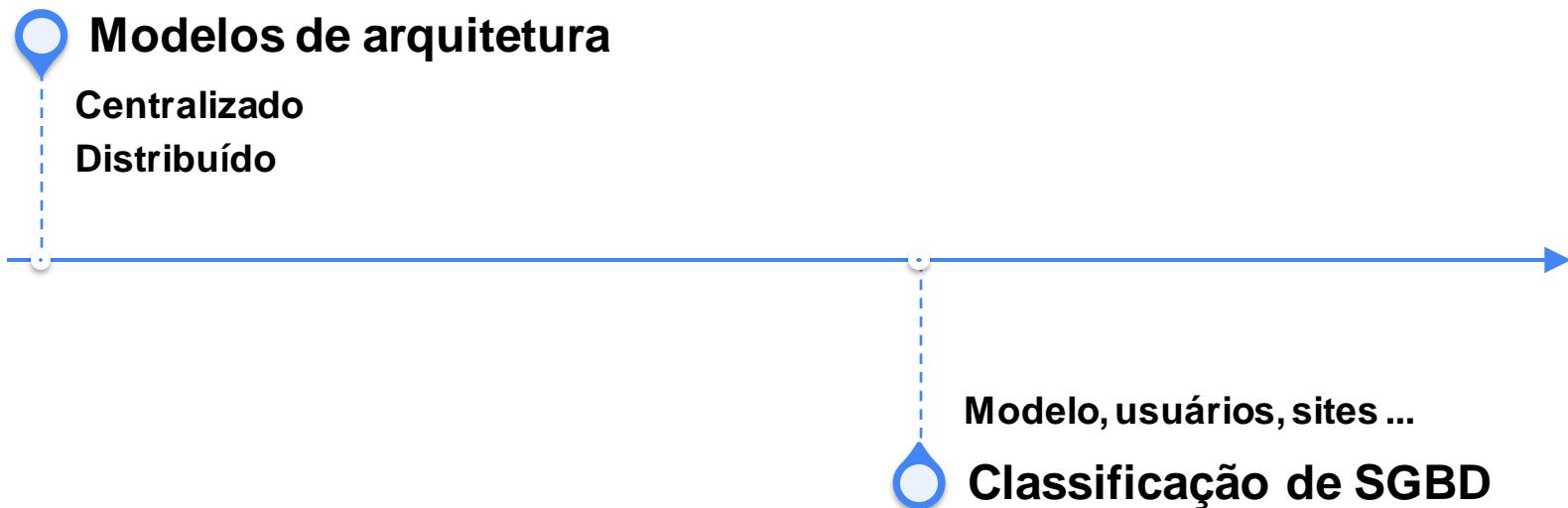


## Etapa 10

# Arquitetura: Modelo Cliente-servidor e Classificação de SGBDs

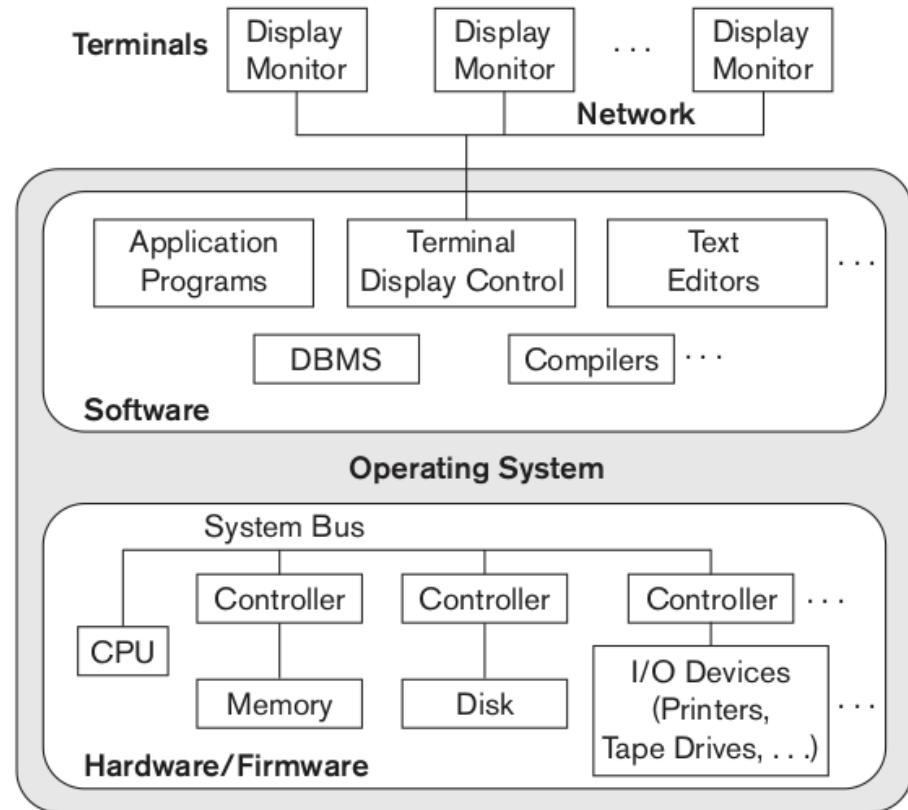
// Introdução à Banco de dados

# Conversa

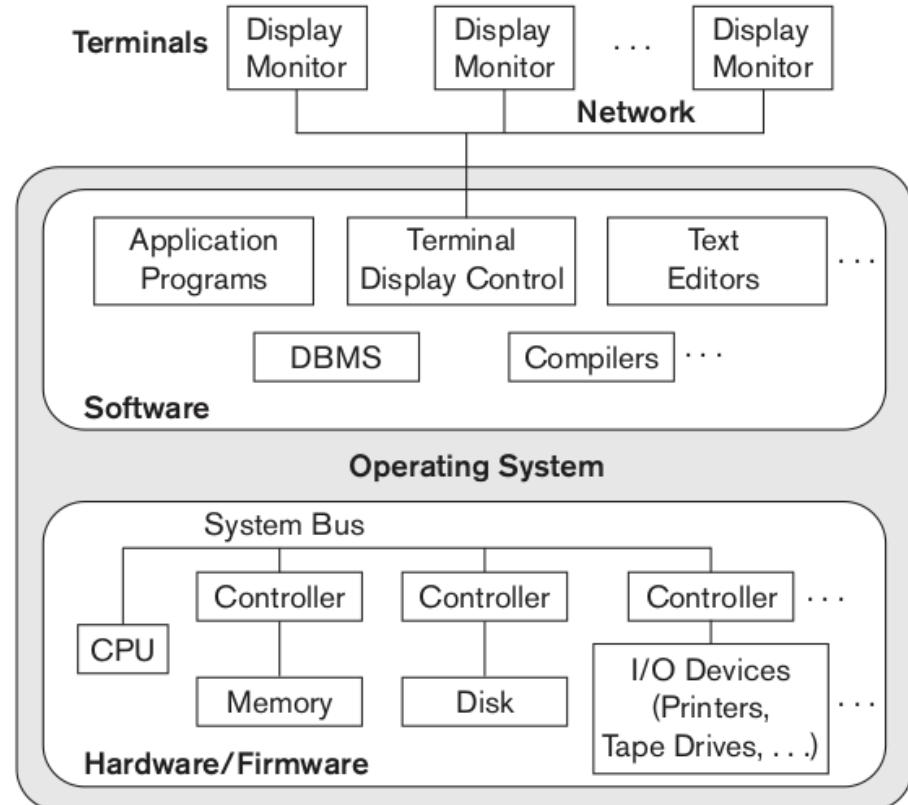
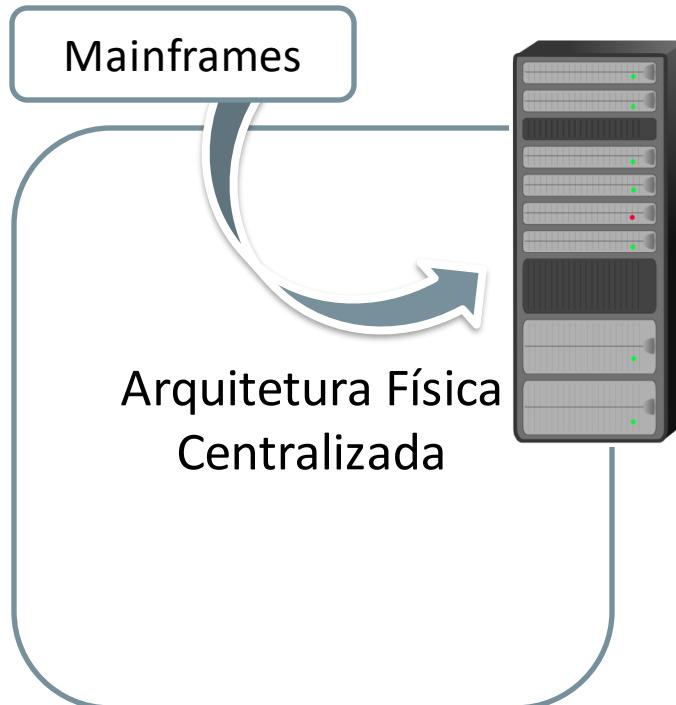


# Arquitetura

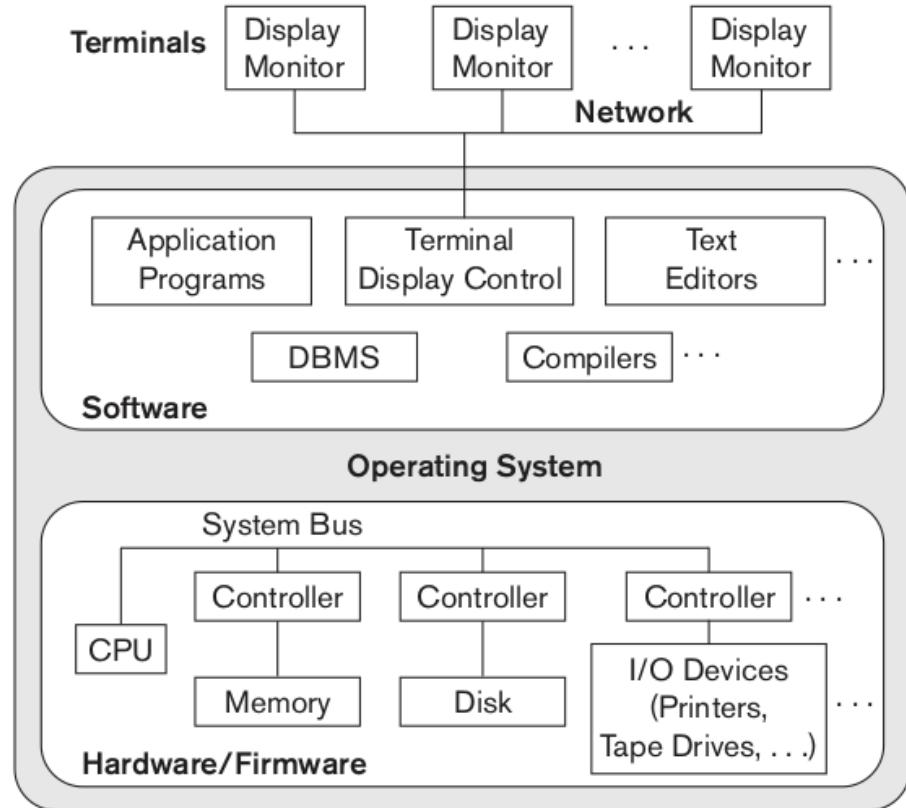
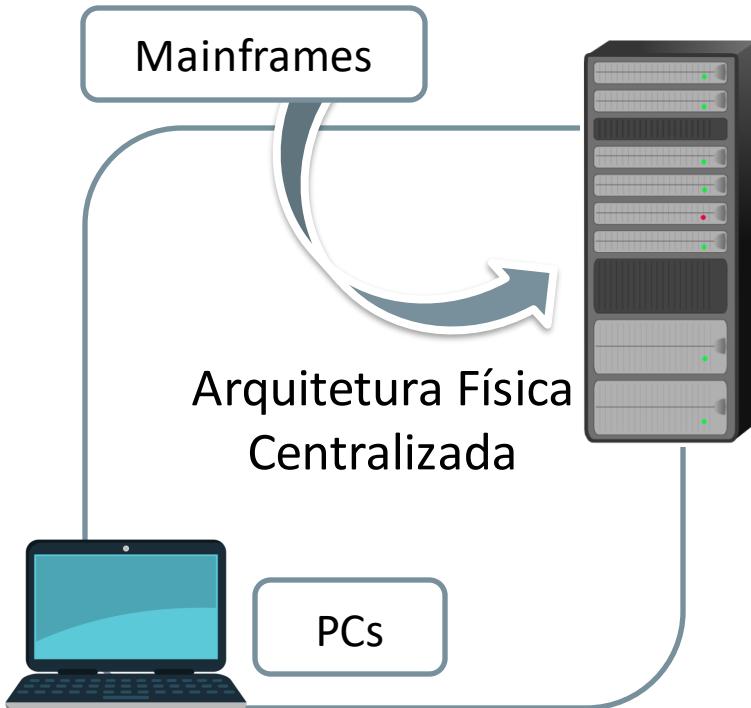
Arquitetura Física  
Centralizada



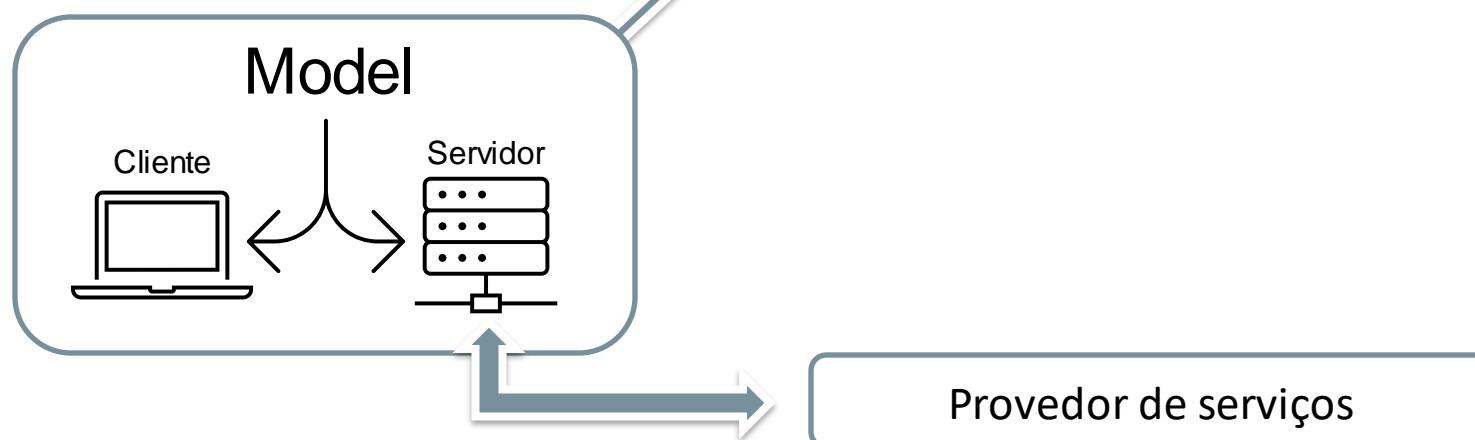
# Arquitetura



# Arquitetura



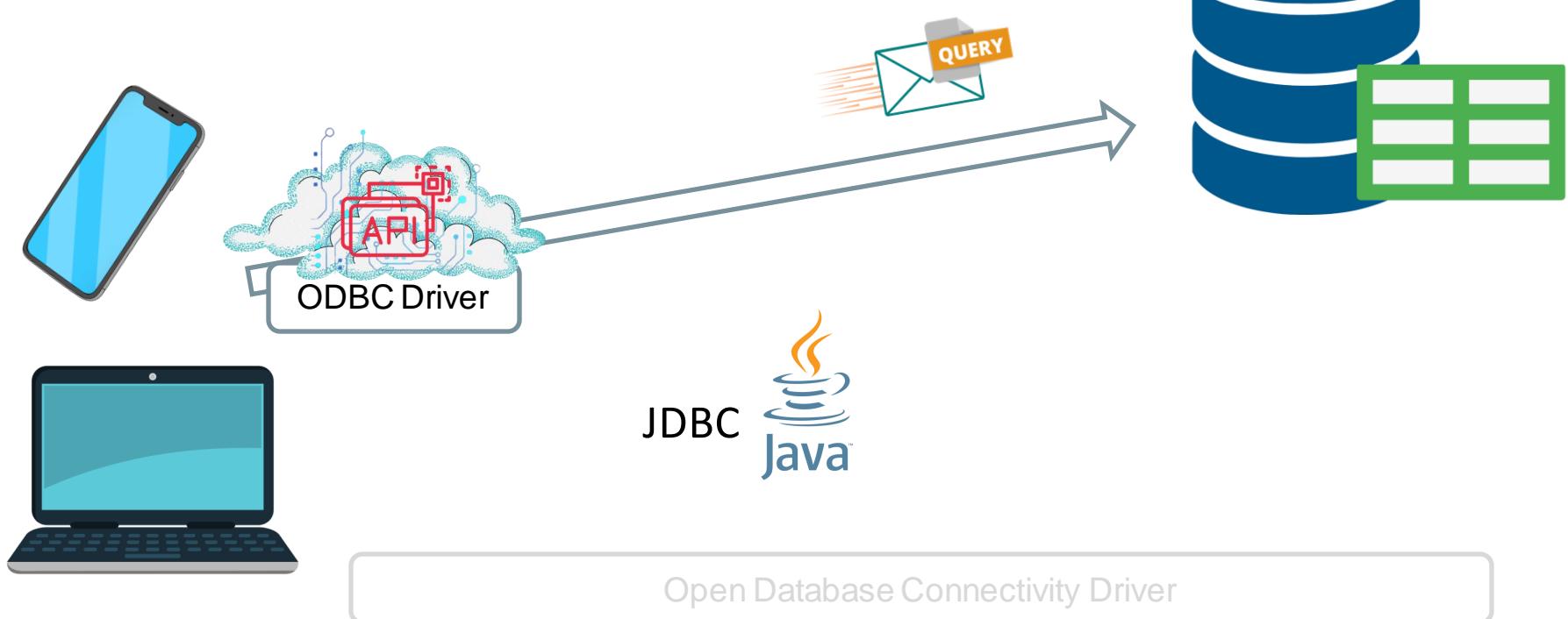
# Arquitetura



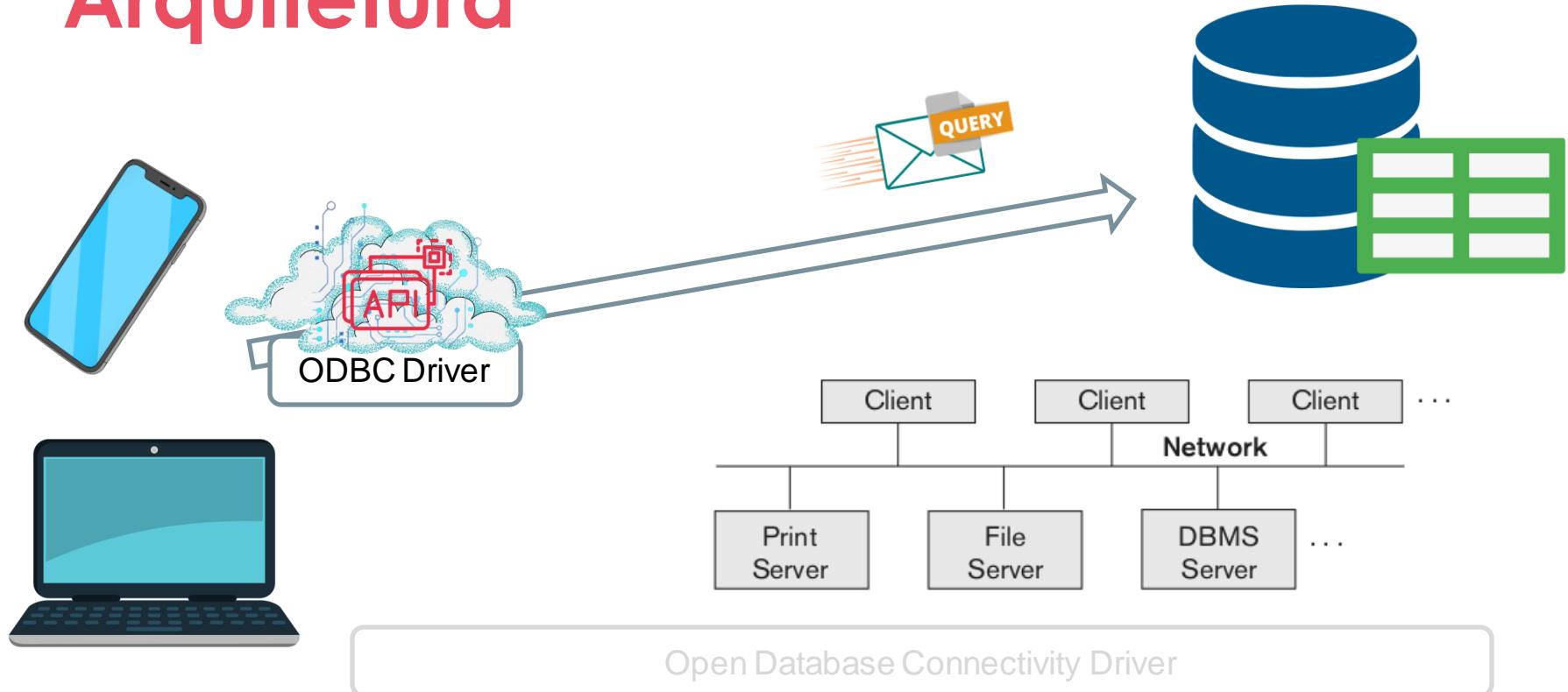
# Arquitetura



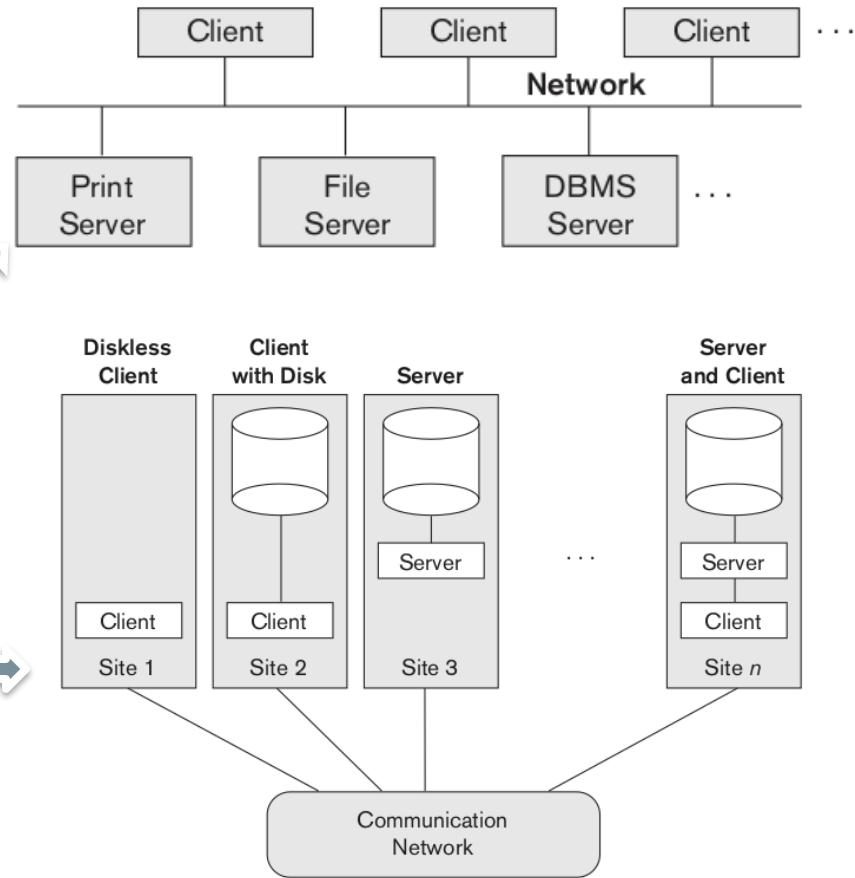
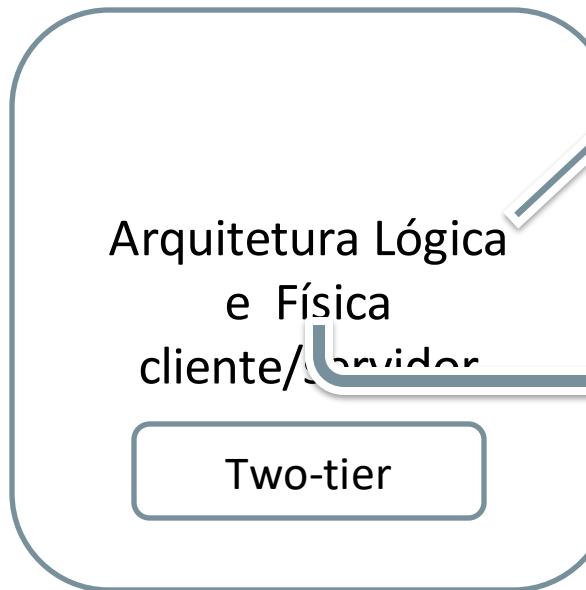
# Arquitetura



# Arquitetura



# Arquitetura

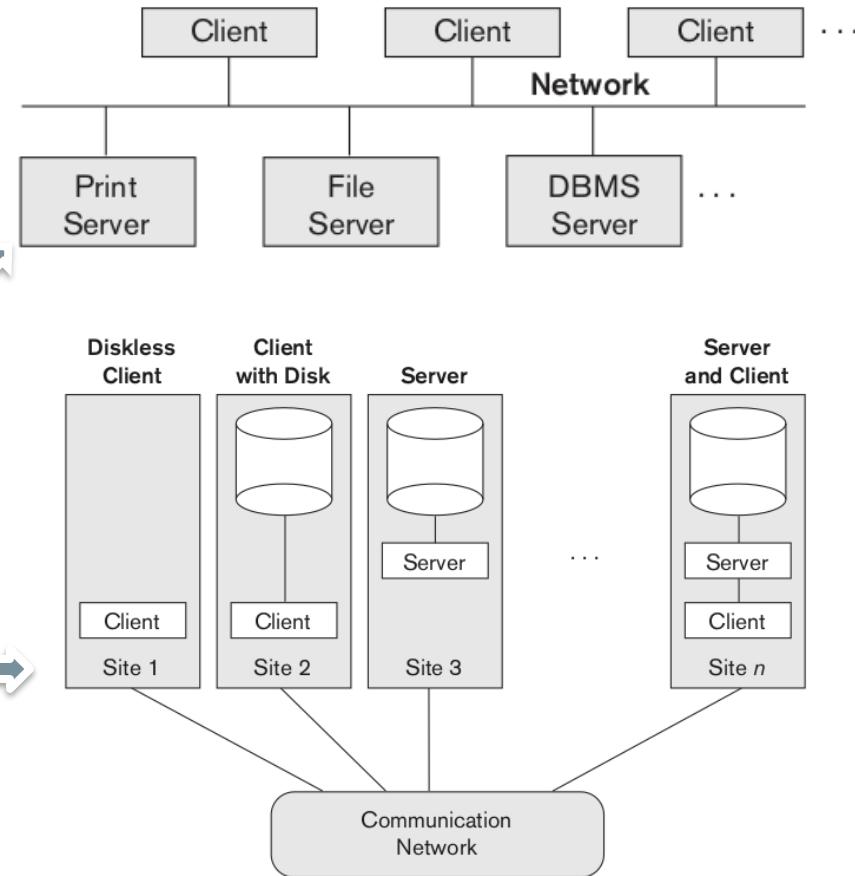


# Arquitetura

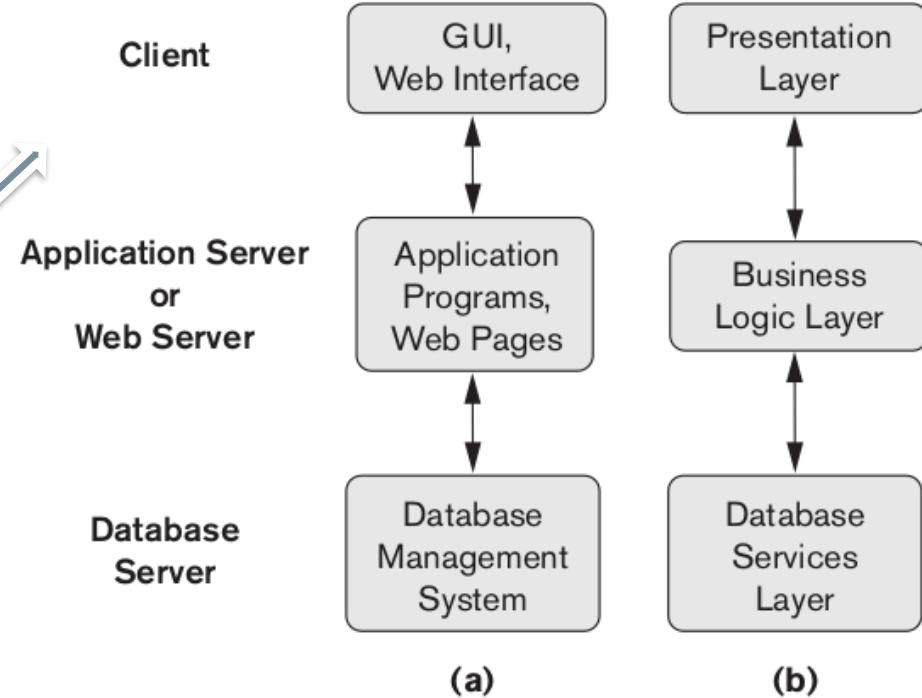
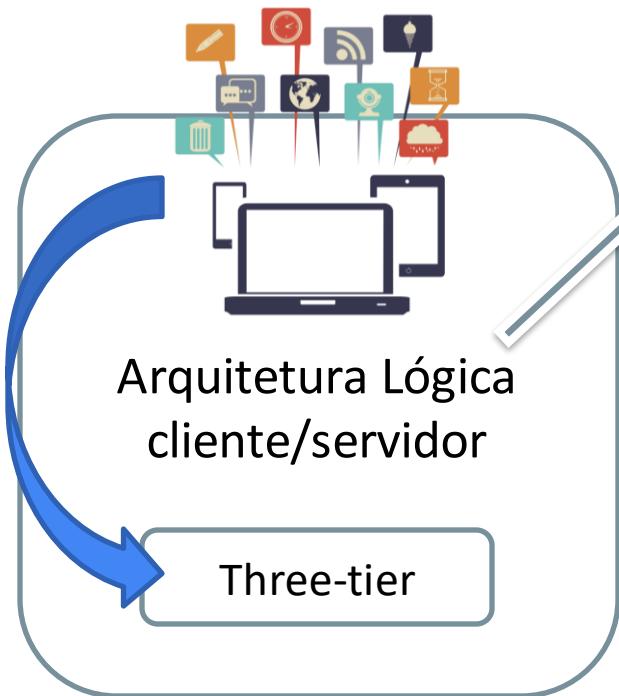
Simplicidade & Compatibilidade

Arquitetura Lógica  
e Física  
cliente/Servidor

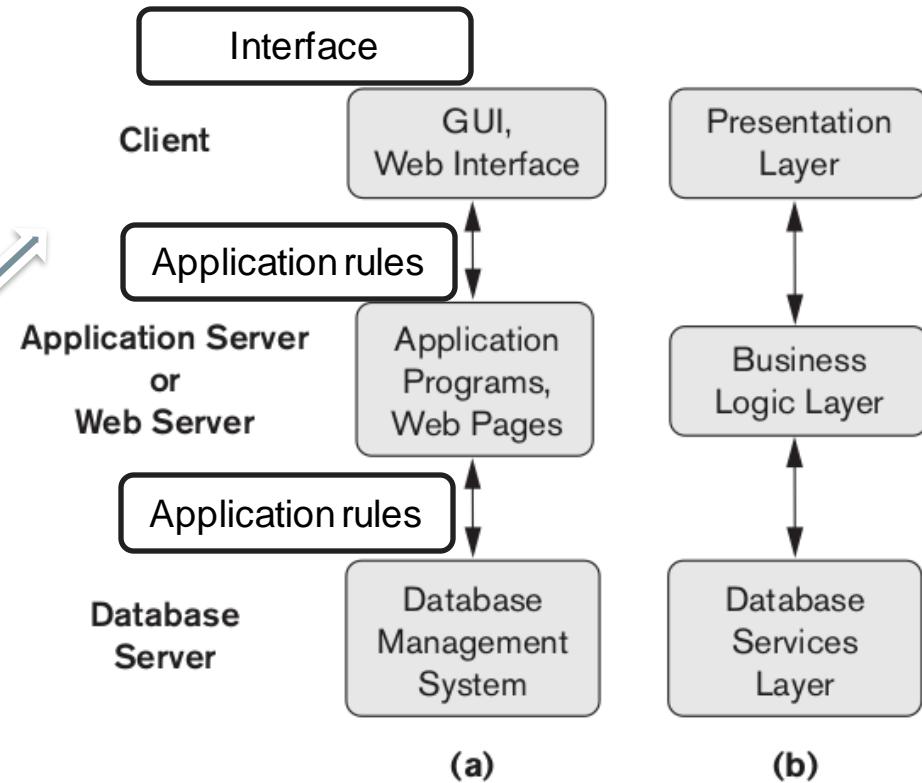
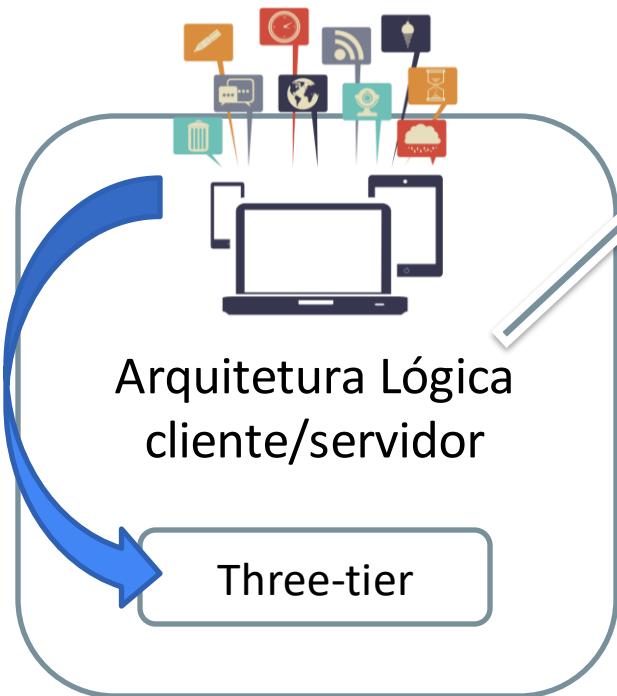
Two-tier



# Arquitetura



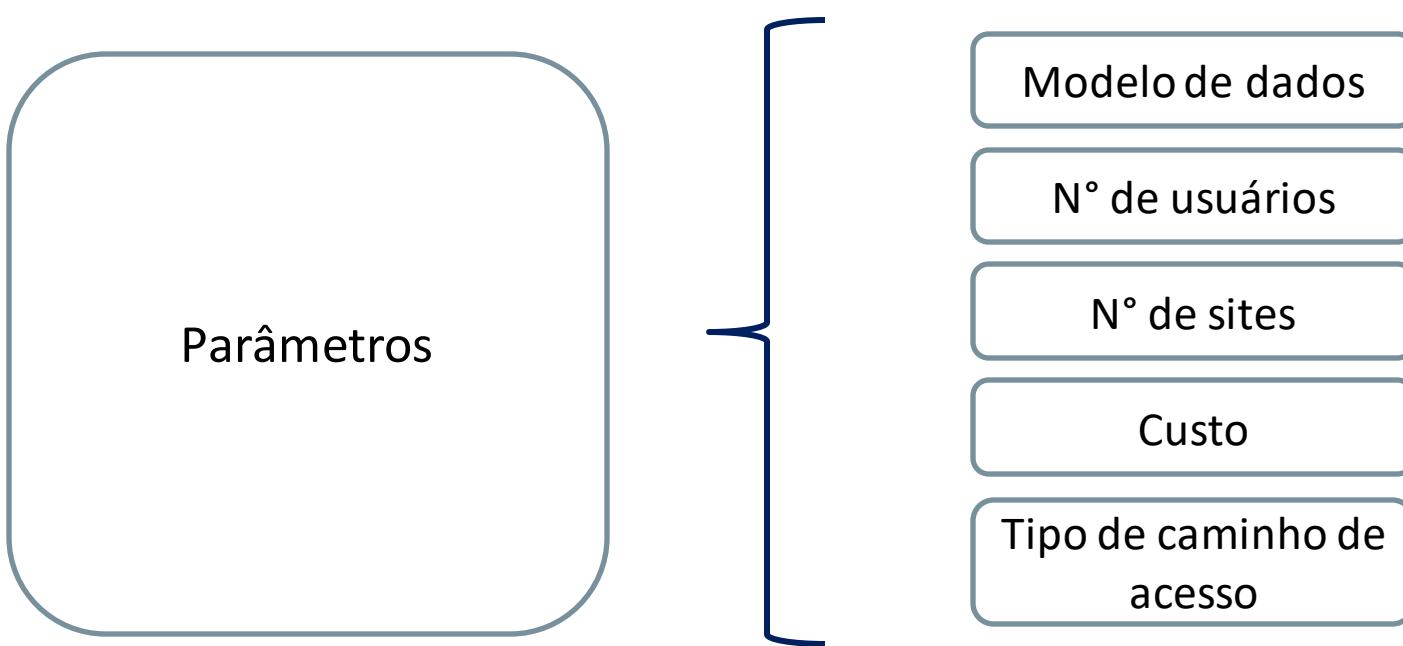
# Arquitetura



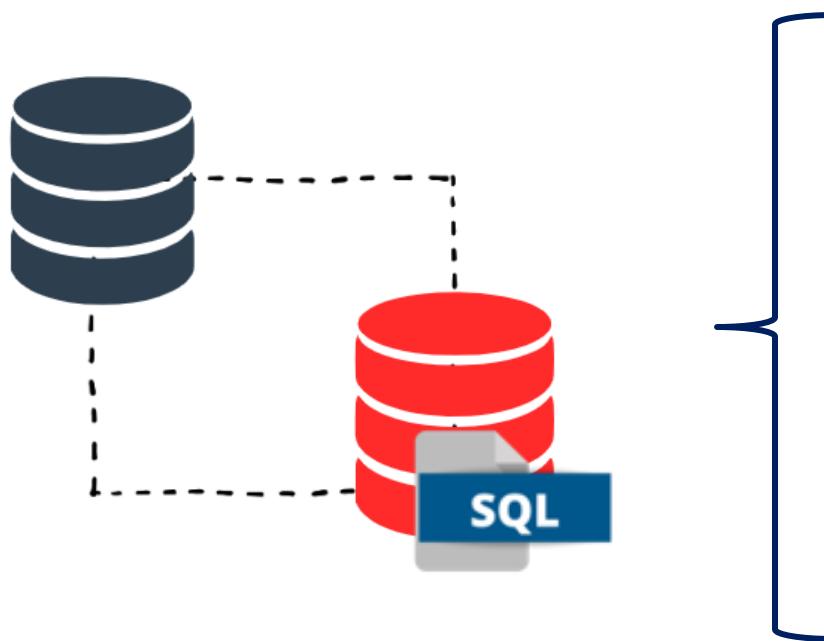
# Classificação de SGBDs



# Classificação



# Classificação



Modelo de dados

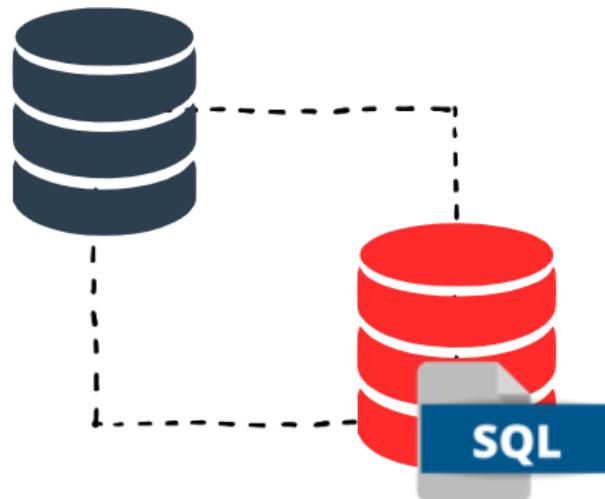
Nº de usuários

Nº de sites

Custo

Tipo de caminho de  
acesso

# Classificação



Modelo de dados

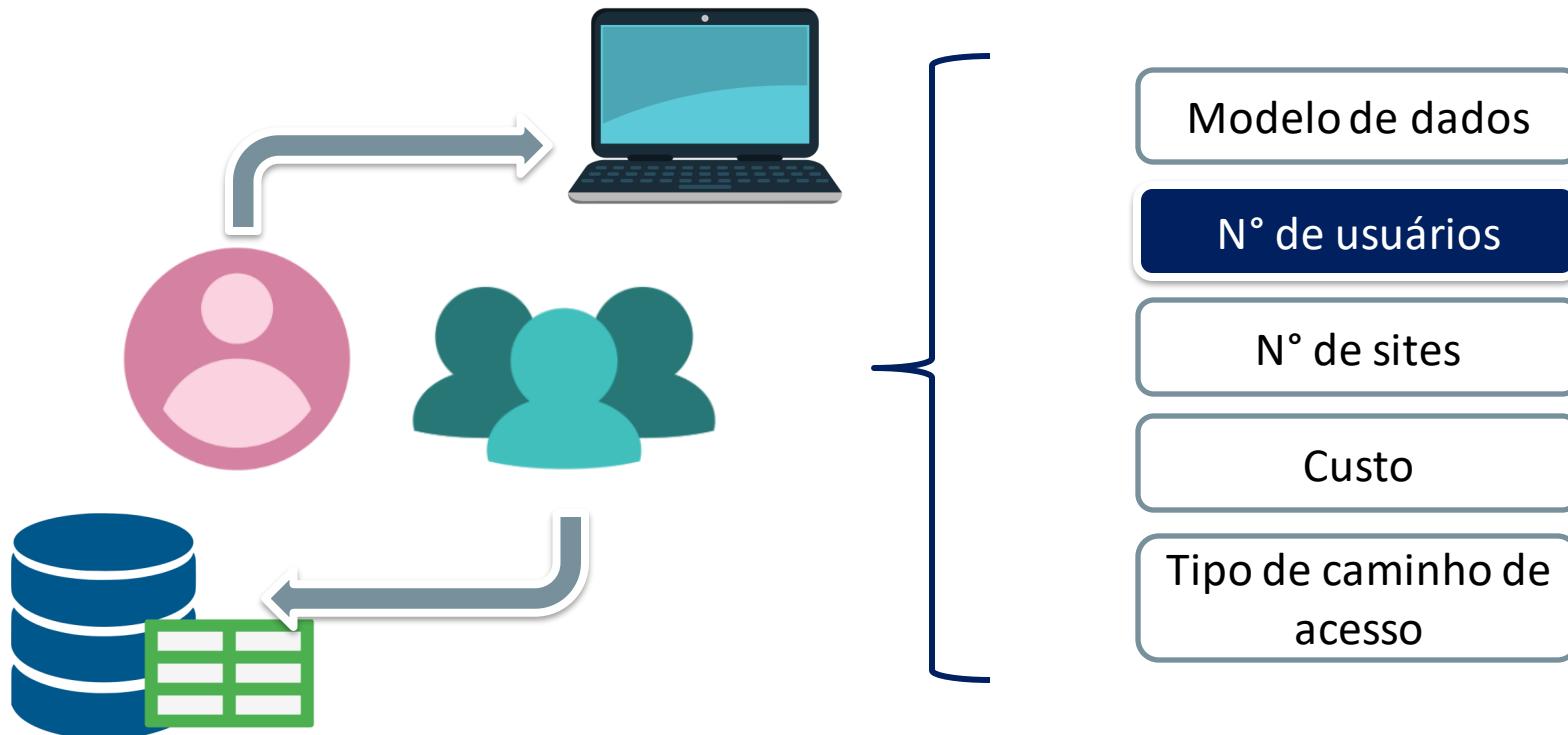
Nº de usuários

Nº de sites

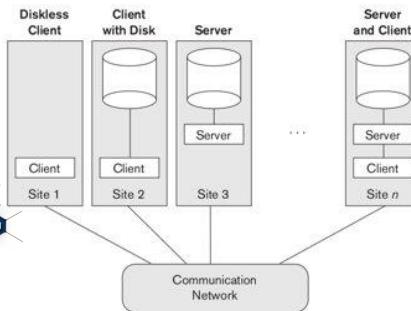
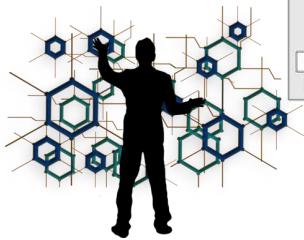
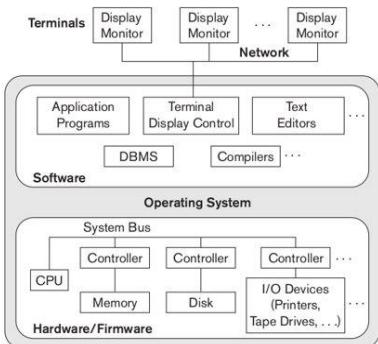
Custo

Tipo de caminho de  
acesso

# Classificação



# Classificação



Modelo de dados

Nº de usuários

Nº de sites

Custo

Tipo de caminho de acesso

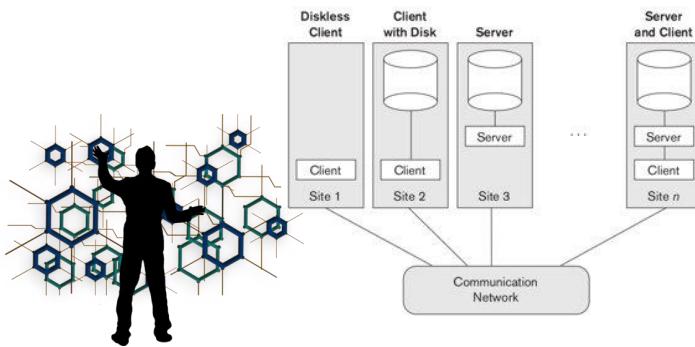
# Classificação

Big data

Replicação

DB federado

Heterogeneidade



Modelo de dados

Nº de usuários

Nº de sites

Custo

Tipo de caminho de acesso

# Classificação



**ORACLE®**

User licences

Módulos: replicação, paralelismo ....



Modelo de dados

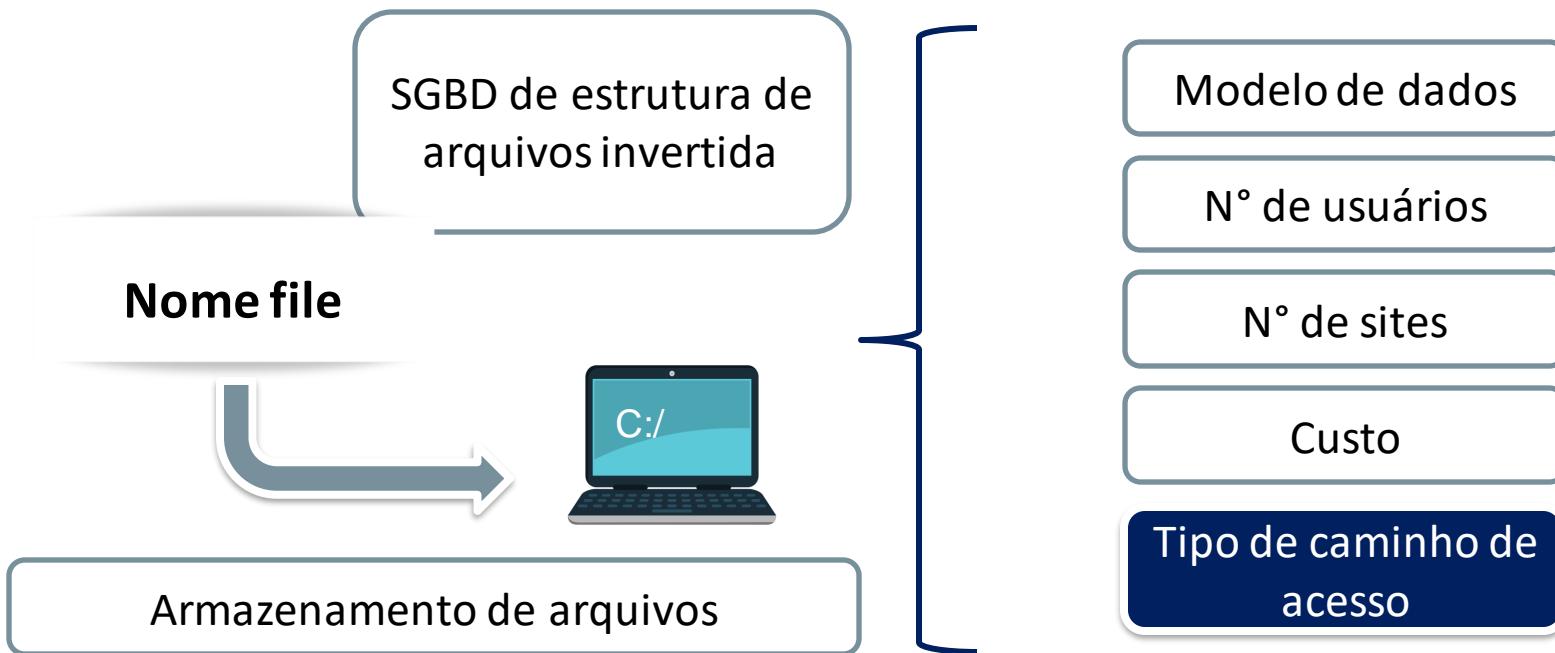
Nº de usuários

Nº de sites

Custo

Tipo de caminho de  
acesso

# Classificação



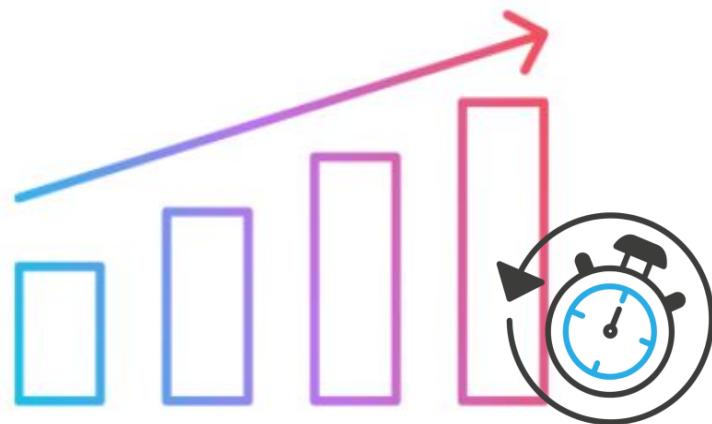
# Classificação

Performance



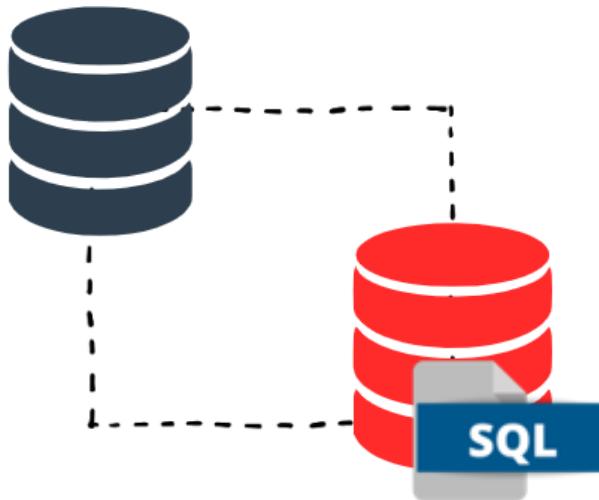
SGBD de Propósito Geral

# Classificação



SGBD de Propósito Geral

# Classificação - Relacional



Coleções de tabelas

Tabela



File

Alto Nível

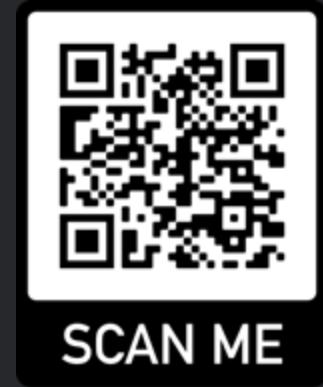
View



User

# Dúvidas?

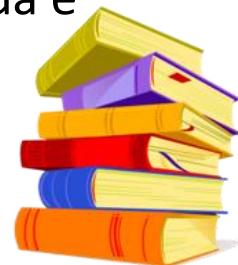
- > Fórum/Artigos
- > Comunidade Online (Discord)



# 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:

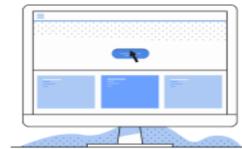
<https://www.ime.usp.br/~andrers/aulas/bd2005-1/aula3>

<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>

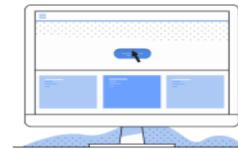


# Para saber mais

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

