Front Matter

a dot com

Outline

- Item 1
- Item 2
- Item 3

Nice to Meet You!

- Life: 45 yo, married + 3 kids, live in Shoham, Yoga.
- Work:
  - Current: 2 yrs @ At-Bay as a Software Architect (...what's that?)
  - Overall: ~15 yrs in the industry, mostly in startups, but fallen a couple of times to the corporate hands
  - Fun time 1: Does Tech Due Diliginces for a couple of VCs
  - Fun time 2: Contributor to the Dapr open source project
  - Fun time 3: this thing
- Formal:
  - B.Sc in Biotechnology & Environmental Science from Tel-Hai College
  - M.Sc in Biochemistry from Weizmann Institute of Science
  - Ph.D studies in Biophysics (I didn't complete) from Weizmann

What We'll Talk About

- Software architecture - theory
- We theory meets reality
- The oh-so-boring SaaS company
- The *relational database* as the greatest invention in industrial software engineering
- Where the relational database *fails*
- Q & A

Software Architecture

Wikipedia

- "Software architecture refers to the fundamental structures of a software system and the discipline of creating such structures and systems."
- "Each structure comprises software elements, relations among them, and properties of both elements and relations."
- system:
    - structures:
        - element <-- relation --> element

Software Architecture

Static Analysis of a System

- "Software architecture is about making fundamental structural choices that are costly to change once implemented" (wikipedia, this time getting it right)
- What's costly to change (over time):
  - Programming Language (changing/adding mostly breaks common tools) --> "element"
  - Data Model (breaks everything if done wrong) --> "property of an element"
  - Runtime Environment (on-prem vs cloud x/y/z) --> "structure+system"
  - Contracts (APIs) --> "relations"

Software Architecture

System Design

- "Fighting" the windmills of **complexity** as software obeys the 2nd law of thermodynamics (complexity never decreases)
- But what is complex? ("This part of the codebase doesn't *feel* right!")
- When do you surrender to the evil called "management"?
- The humanity! (You care about people not losing their minds)

Software Architecture

Evaluation

Also know as **reviewing things**:

- High Level Design Review - system
- Code Reviews - quality
- Security Reviews - security safety
- Test Review - code safety
- Data Modeling Review - correct abstraction/database performance
- DevOps Review - environment/deployment
- SRE Review - gauges

 Make sure stuff alines with your company *vision* on how software is being made

Software Architecture

Evolution

- Fun/easy stuff is to do *NEW* things
- NotSoFun/hardest stuff is to evolve *OLD* things
- Read about: "evolutionary architecture"

Ope There Goes Gravity (E. minem)

- The ideal picture is a fantasy
- You have to **surrender** to accepting these:
  - You and your work are **not eternal**
  - There is no ”generic” best architecture
  - Even the "best" code is eventually **thrown** to the recycle bean
  - You are working for a company that in its essence is a machine made to make **profit**
  - ʊt the broader picture, *individual skills*, are **irrelevant**. Collaboration is key
- None of the above is in contradiction to software development being a beautiful human mental act

The Oh-So-Boring SaaS Company

- Capture *Data*
- Do something over *Data*
- Arrange the *Data* nicely
- Ask for money from customers/advertisers

The Data Model

Data Model == Database Tables

- It is how you model the business entities
- **It is the single most important element in the system design of a SaaS**
- It is the only effort worth investing BEFORE writing a single line of code (atypical for a startup to do)
- Still, it is ever evolving with the business needs, but once in use, *it is hard to change*
- Things that aren't persisted are potentially lost, so the use of in-memory data structures (with all due respect to BigO) is just temporary and the **significant stateful operations are done over a database**

Data Model - Implementation

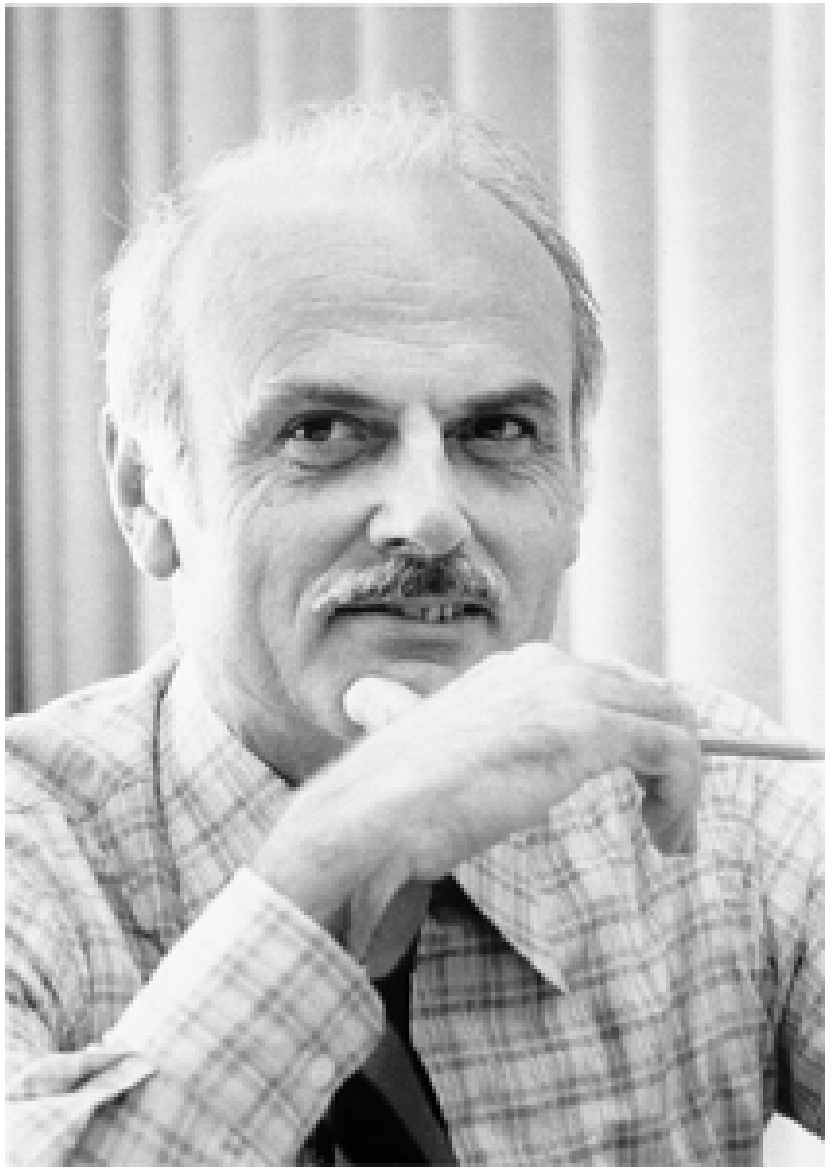
Usually, we're talking about a *Relational Database*

Rank			DBMS	Database Model	Score		
May 2022	Apr 2022	May 2021			May 2022	Apr 2022	May 2021
1.	1.	1.	Oracle	Relational, Multi-model	1262.82	+8.00	-7.12
2.	2.	2.	MySQL	Relational, Multi-model	1202.10	-2.06	-34.28
3.	3.	3.	Microsoft SQL Server	Relational, Multi-model	941.20	+2.74	-51.46
4.	4.	4.	PostgreSQL	Relational, Multi-model	615.29	+0.83	+56.04
5.	5.	5.	IBM Db2	Relational, Multi-model	160.32	-0.13	-6.34
6.	6.	↑ 7.	Microsoft Access	Relational	143.44	+0.66	+28.04
7.	7.	↓ 6.	SQLite	Relational	134.73	+1.94	+8.04
8.	8.	8.	MariaDB	Relational, Multi-model	111.13	+0.81	+14.44
9.	9.	↑ 16.	Snowflake	Relational	93.51	+4.06	+63.46
10.	10.	10.	Microsoft Azure SQL Database	Relational, Multi-model	85.33	-0.45	+14.88

Relational Databases

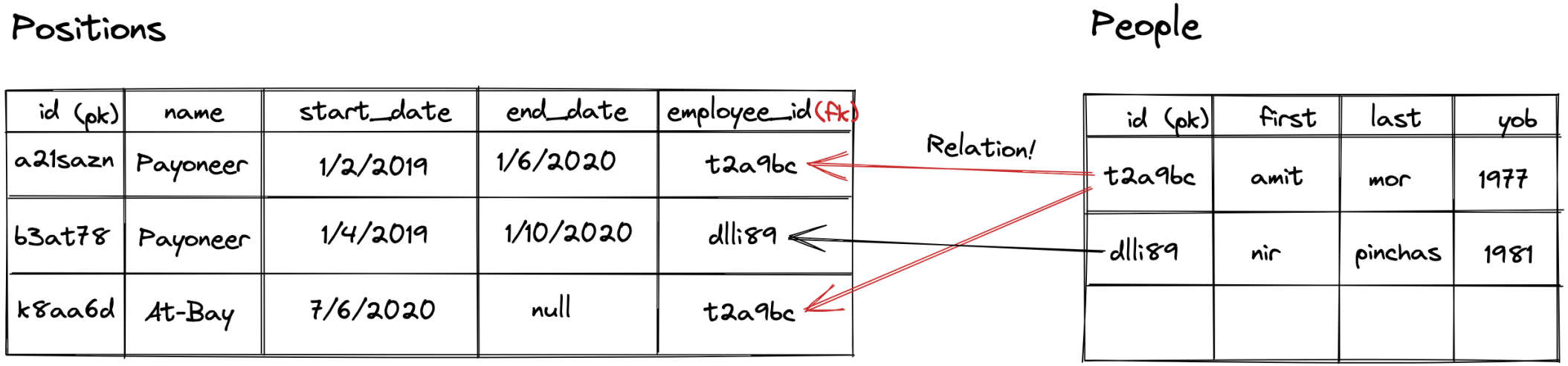
The founding father of the relational model is *Edgar F. Codd*

- Based on his work published in 1970 (yes, 52 yo technology) while he was working for IBM
- He won the Turing Award in 1981 for this work
- He applied Relational Algebra and proposed such an algebra as a basis for database query languages
- Five primitive operators: selection, projection, Cartesian product (also called cross join), set union, set difference.



Relational Databases - Basics

- Relational databases are all about **tables**
- Tables are able to *relate* to one another

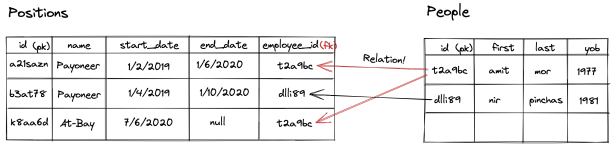


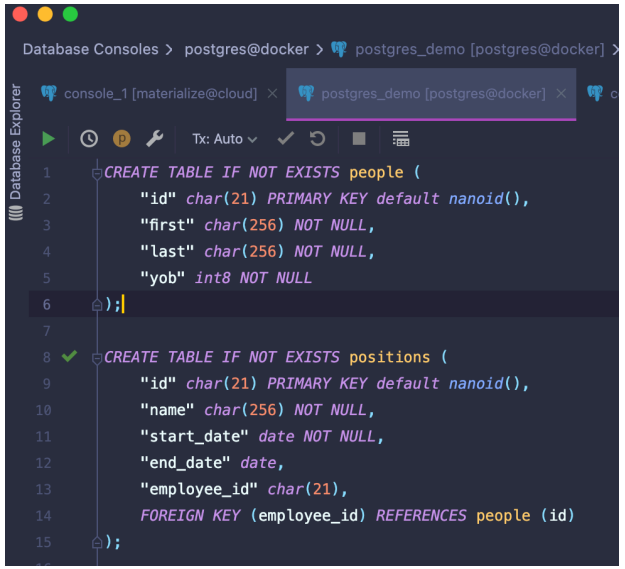
- Use a **declarative** language to apply operations over the logical representation and don't mind the physical aspects
- Ability to create meaningful information by **joining** of tables
- To ensure that data is always accurate and accessible, relational databases follow certain integrity rules (**A.C.I.D**)
- Relational databases are **transactional**—they guarantee the state of the entire system is consistent at any moment
- The relational model means that the *logical data structures*—the data tables, views, and indexes—are separate from the *physical storage structures*

// todo: move these two

- You'd rarely find a company using "raw" SQL queries as it is considered error prone
- Most likely a company would use an ORM framework of

Relational Databases - Declarative Language





Relational Databases - JOINS

Relational Databases - A.C.I.D

Relational Databases - Example

TODO ERD of Customers and Orders tables

Relational Database - Transactions & 2PC

The only model that is able to guarantee correctness of a system

A query from my service over the data ALWAYS produces the same result as from another service

The cost is database row/table locking and performance hit (which is nowadays negligible)

This is key for a company that can't accept eventual consistency (regulatory) or that it's business flow is sequential

ACID

Literature

- wikipedia
- http://users.ece.utexas.edu/~perry/work/papers/swa-sen.pdf
- https://www.goodreads.com/book/show/296981.Object_Oriented_Software_Engineering
- https://thevaluable.dev/fighting-software-entropy/
- E.F. Codd paper