

GraphQL

Does it replace SQL, REST or Something Else?

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Agenda

01/ First Principles

02/ GraphQL

03/ SQL

04/ REST

05/ Demo

06/ The Answer

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Speaker

- Started as Linux admin in 2000
- Automation!
- Ansible
- Python
- Pre-Sales Solutions Engineer at Couchbase

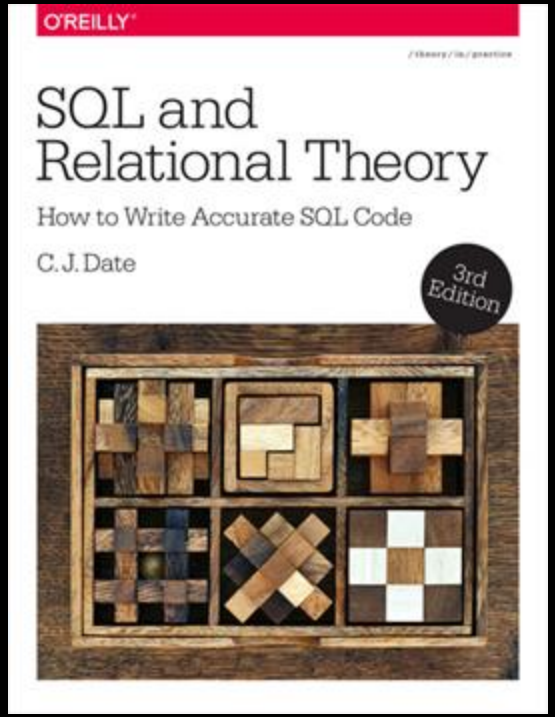


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1 First Principles

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First Principles in Data Management



C.J. Date worked at IBM in the 70s on System R and others.

Rooted in the “it could have been so much better”, but defines a path based on first principles.

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The Original Relational Algebra

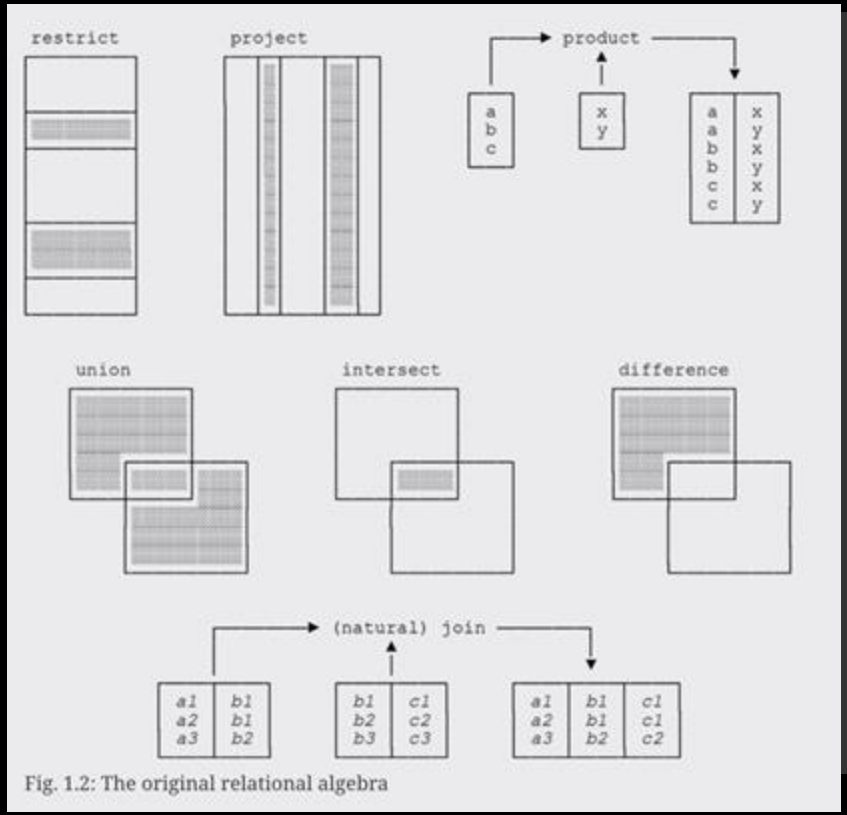


Fig. 1.2: The original relational algebra

Relational Model Principles

Structure

- Relations, n-ary relations
  - Types: Department No

Integrity

- Entity integrity (primary key not null)
- Referential integrity (no unmatched foreign keys)

Manipulation

- Restrict
- Project
- Product
- Union
- Intersect
- Difference
- Join

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2 GraphQL

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What is GraphQL?



Specification

- Created at Facebook in 2012 to solve some key problems
- Published in 2017, foundation in 2019

Conference

- Sept 10-12 in San Francisco

Foundation

- Subset of Linux Foundation

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Motivation

~~Everyone loves XML-RPC!~~

~~Everyone loves SOAP!~~

Everyone loves REST!

Except…

- Size
- Versioning (and deprecation)
- Mapping

Everyone loves GraphQL!

```
% curl -X GET https://api.github.com/users/ingenthr
{
  "login": "ingenthr",
  "id": 81302,
  "node_id": "MDQ6VXNlcjgxMzAy",
  "avatar_url": "https://avatars.githubusercontent.com/u/81302?v=4",
  "gravatar_id": "",
  "url": "https://api.github.com/users/ingenthr",
  "html_url": "https://github.com/ingenthr",
  "followers_url": "https://api.github.com/users/ingenthr/followers",
  "following_url":
"https://api.github.com/users/ingenthr/following{/other_user}",
  "gists_url": "https://api.github.com/users/ingenthr/gists{/gist_id}",
  "starred_url":
"https://api.github.com/users/ingenthr/starred{/owner}{/repo}",
  "subscriptions_url":
"https://api.github.com/users/ingenthr/subscriptions",
  "organizations_url": "https://api.github.com/users/ingenthr/orgs",
  "repos_url": "https://api.github.com/users/ingenthr/repos",
  "events_url": "https://api.github.com/users/ingenthr/events{/privacy}",
  "received_events_url":
"https://api.github.com/users/ingenthr/received_events",
  "type": "User",
  "site_admin": false,
  "name": "Matt Ingenthron",
  "company": "Couchbase, Inc.",
  "blog": "http://blogs.ingenthron.org/matt",
  "location": "Orange County, CA, USA",
  "email": null,
  "hireable": null,
  "bio": null,
  "twitter_username": null,
  "public_repos": 84,
```

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Interface



Query by Example

```
query {
        airline(name: "Air France") {
        id
        type
        name
        iata
        icao
        callsign
        country
        }
}
```

```
{
  "data": {
        "airline": [
        {
        "callsign": "AIRFRANCE",
        "country": "France",
        "iata": "AF",
        "icao": "AFR",
        "id": "137",
        "name": "Air France",
        "type": "airline"
        }
        ]
  }
}
```

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Schema



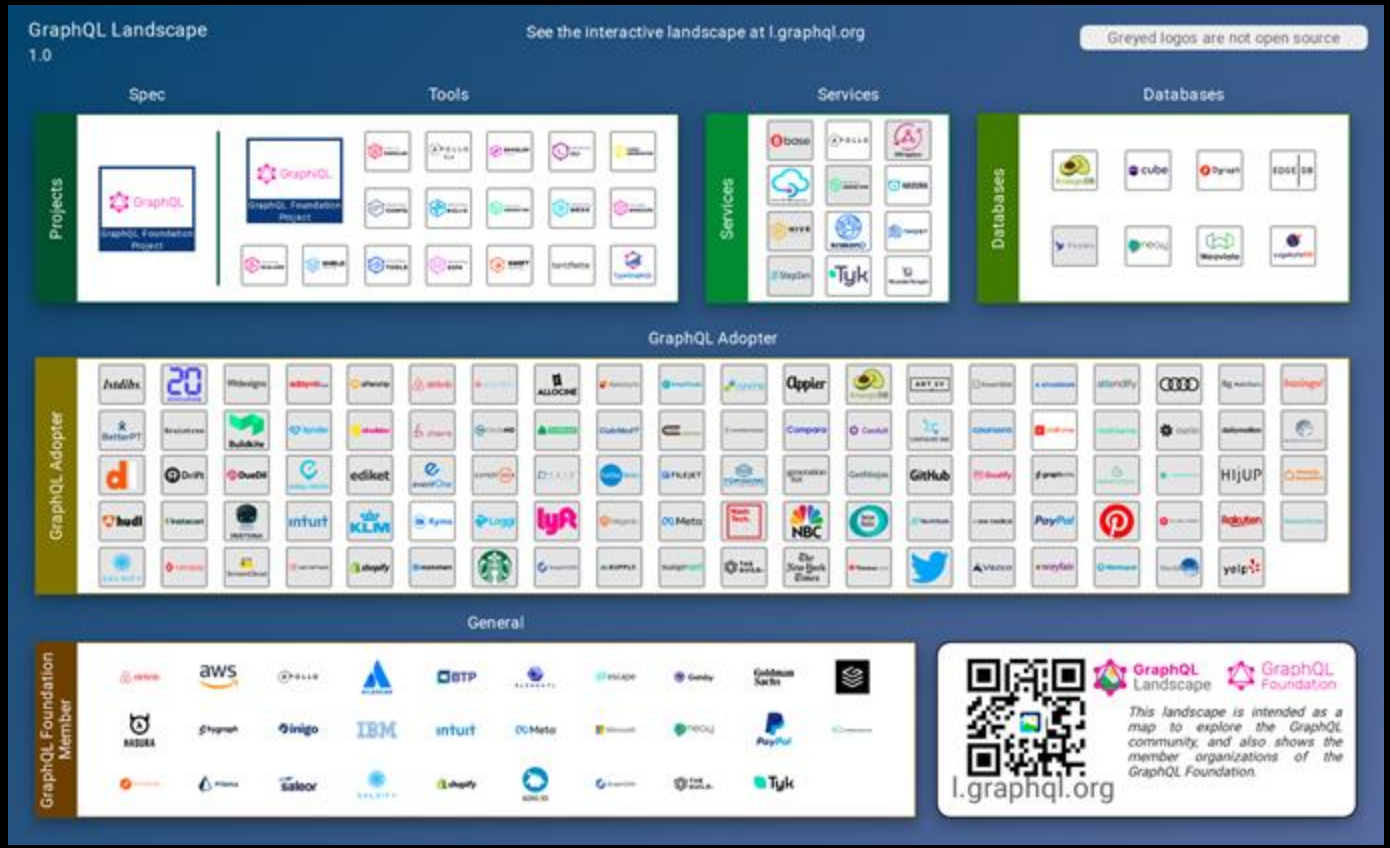
```
type Query {
                airline(id: ID, type: String, name: String, iata: String, icao: String, callsign: String, country: String): [Airline]
                airlines: [Airline]
}

type Mutation {
                createAirline(id: ID!, type: String, name: String, iata: String, icao: String, callsign: String, country: String): AirlineResponse!
                updateAirline(id: ID!, type: String, name: String, iata: String, icao: String, callsign: String, country: String): AirlineResponse!
                deleteAirline(id: ID!): DeleteResponse!
}

type Airline {
                id: ID!
                type: String
                name: String
                iata: String
                icao: String
                callsign: String
                country: String
}
```

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GraphQL Landscape



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3 SQL and SQL++

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Everyone Knows SQL

SELECT …
FROM …
WHERE …

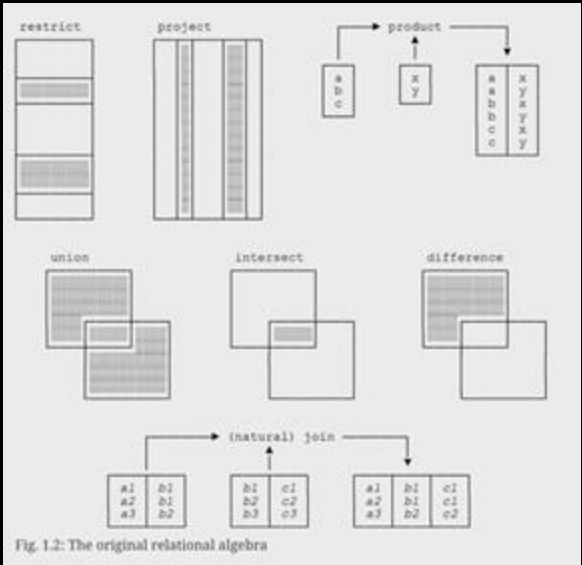


Fig. 1.2: The original relational algebra

Project …
Identifier …
Restrict…

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Modern Take on Recent History

Andy Pavlo: What Goes Around Comes Around… And Around



Somebody invents a "SQL Replacement" every decade. It then fails and/or SQL absorbs the key ideas into the standard.

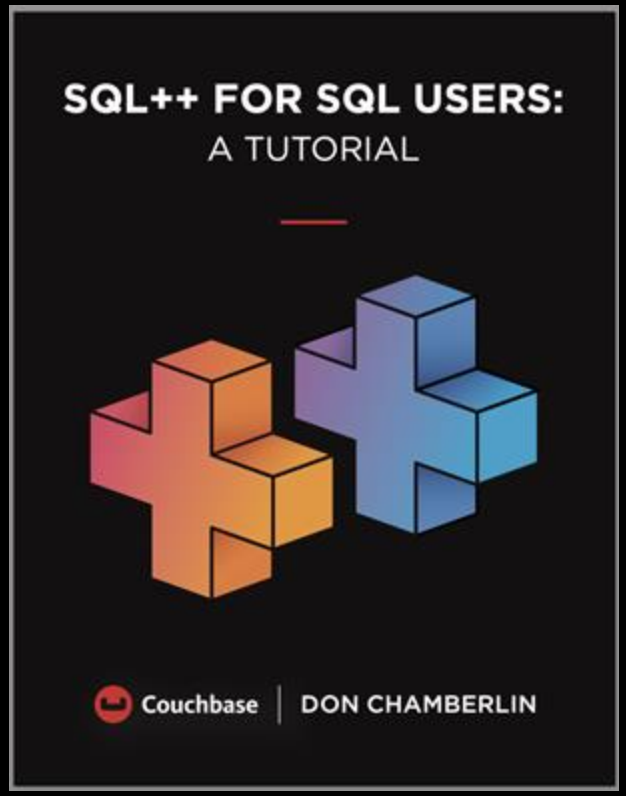
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Andy Pavlo's Take on Where We Are



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SQL Extended for Flexible Schema



- Proposed in paper from UCSD- *The SQL++ Query Language: Configurable, Unifying and Semi-structured*
- Uses a number of ideas to extend the SQL grammar
  - Projecting nested/unnested
  - Handling difference between JSON NULL and IS MISSING

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Route document example



```
route_5966          ← key
{
  "airlineid": "airline_24",              ← "foreign key"
  "sourceairport": "MCO",
  "destinationairport": "SEA",
  "equipment": "737",
  "schedule": [
    {"day": 1, "utc": "13:25:00", "flight": "AA788"},
    {"day": 4, "utc": "13:25:00", "flight": "AA419"},
    {"day": 5, "utc": "13:25:00", "flight": "AA519"}
  ]
}
```



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SELECT

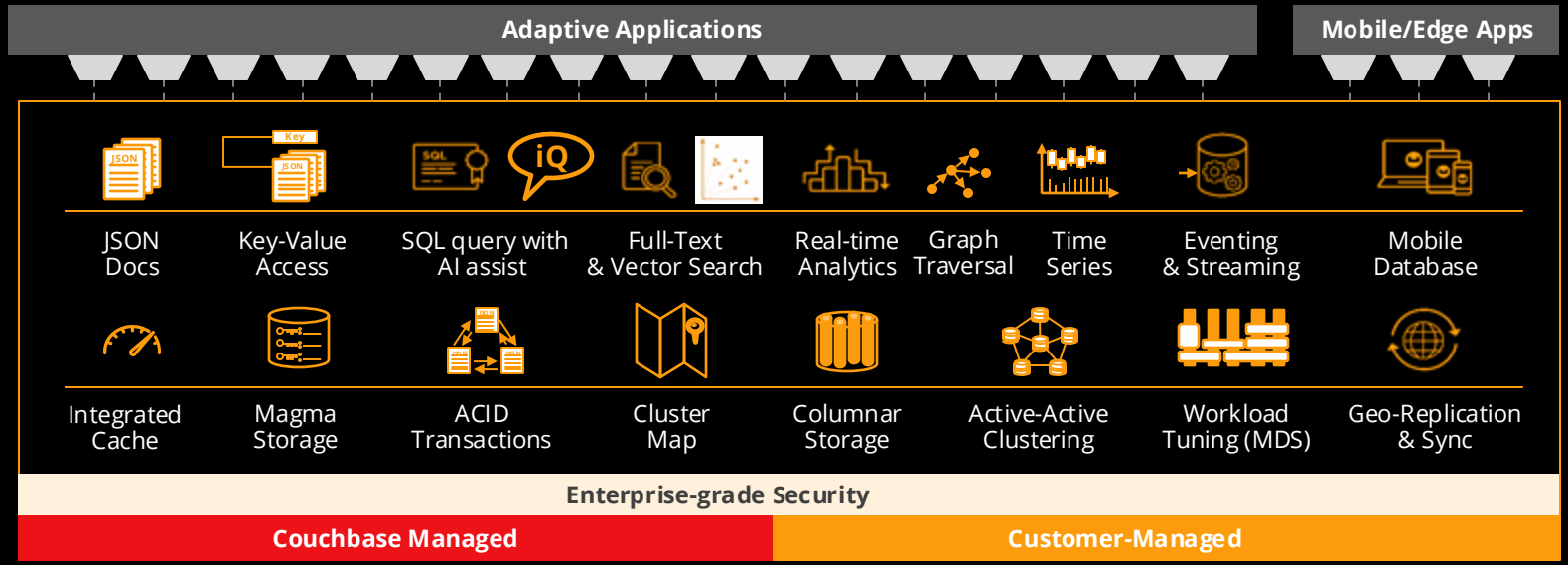
```
SELECT r.airlineid,
       r.destinationairport,
       r.sourceairport
FROM route r
LIMIT 10;
```



```
[
  {
    "airlineid": "airline_137",
    "destinationairport": "MRS",
    "sourceairport": "TLV"
  },
  {
    "airlineid": "airline_137",
    "destinationairport": "NCE",
    "sourceairport": "TLV"
  },
  {
    "airlineid": "airline_137",
    "destinationairport": "CDG",
    "sourceairport": "TNR"
  },
  {
    "airlineid": "airline_137"
```


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Broad Platform Capabilities: Innovate Faster with Couchbase



- Build feature-rich applications
- Less complexity & data sprawl

- High Performance and Scale
- Reliable, Trustworthy AI interactions

- Lower operational costs
- Lower infrastructure costs

"It's unusual to get more features, in less time and save money,... all at once."

Phil Lupercio
VP of Technology
BroadJump

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4 REST

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REST



HTTP and Hypertext

REST is what we all do… or do we?

Hypermedia As The Engine Of Application State

> *With HATEOAS, a client interacts with a network application whose application servers provide information dynamically through hypermedia. A REST client needs little to no prior knowledge about how to interact with an application or server beyond a generic understanding of hypermedia.*

- Discoverable, including links
- Properly use the HTTP verbs

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REST



curl -X GET http://127.0.0.1:8501/airline?id=1234


```
[
  {
        "callsign": "NEW AIR",
        "country": "USA",
        "iata": "NA",
        "icao": "NWA",
        "id": "1234",
        "name": "New Airline",
        "type": "airline"
  }
]
```


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5 Demo

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6 The Answer

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What do I Choose?



Different tools in the toolkit…

GraphQL

+ Creates agreement on format.
+ Creates stronger interface definition.
- Less approachable.
- Less widespread.

Verdict: Great service interface to mobile apps

SQL(++)

+ The language of data access.
+ Rooted in principles.
+ Large Ecosystem
- Tends to have varying dialects.

Verdict: Extends into all of the corners of data access and data management.

REST

+ The language of data retrieval on the Internet.
+ More approachable.
- Looser interface, brittle.

Verdict: Common language on the Internet, even with regional differences.

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Questions?

THANK YOU



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References



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Learn GraphQL Docs: https://graphql.org/learn/queries/

Remarks on the Algebra of Non-First Normal Form Relations: https://doi.org/10.1145/588111.588133

SQL++ for SQL Users: https://resources.couchbase.com/analytics/sql-book

History of Databases: https://15721.courses.cs.cmu.edu/spring2023/slides/01-history.pdf

REST APIs must be hypertext driven: https://roy.gbiv.com/untangled/2008/rest-apis-must-be-hypertext-driven

Demo: https://github.com/grbade/cb_graphql_rest_demo/tree/main

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