

MongoDB und LLMs:

*ab in die Cloud, keine
Zauberbohnen erforderlich!*

Mi, 20.03.2024



Referenten: Fabian Brandl | Luca Wunderlich





Einsatzbereiche und Karrierechancen bei IGZ

IGZ Softwareentwickler | Fabian Brandl

Fabian Brandl





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□ IHK-Abschlussarbeit: Offline Client für Projektportal (Tuleap)

The screenshot shows a web-based project management system. At the top, there's a navigation bar with links like 'Winkler Wien ZL' and 'PROJEKTPORTAL'. Below it is a search form with fields for 'Lfd. Nr.', 'Testfall', 'Beschreibung', 'Status', 'Status Datum', 'Tester', 'Auswirkung', and 'Kommentar'. A large blue arrow points from this screen to the right-hand screenshot.

Lfd. Nr.	GS	HVO	Testfall	Status	Status Datum	Tester	Auswirkung
299	BR01	1	Telegrammübertragung	offen			
300	BR01	1	Positiver Auftrag	offen			
301	BR01	1	Negativer Auftrag	offen			
321	BR01	1	Hardware Störungen Brüten	offen			
328	BR01	1	WinCC Brüten	offen			
331	BR01	1	Online Daten sichern	offen			
332	BR01	1	Werte in den Achsen einstellen (PositionierungD)	offen			

The screenshot shows a desktop application titled 'IGZ Testportal Client'. It has a toolbar with various icons like 'Online', 'Listen hinzufügen', 'Aktuelle Liste entfernen', 'Erfolgreich', 'Bearbeiten', 'Download', 'Upload', 'Zurücksetzen', 'Liste', 'Zurücksetzen', and 'Handbuch'. The main area displays a table of test cases. The first two rows are expanded to show more details. A large blue arrow points from the left screenshot to this one.

Lfd. Nr.	Testfall	GS	HVO	Beschreibung	Erwartetes Ergebnis	Status	Status Datum	Tester	Auswirkung
1	Test Handbetrieb (mit WinCC)	G501	1	Alle Funktionen des HVO's im Handbetrieb testen	Alle Funktionen des HVO's funktionieren wie geplant	erfolgreich	17.11.2016	IGZ Fabian Brandl (fbra)	
2	Test Handbetrieb (mit WinCC)	G501	2	Alle Funktionen des HVO's im Handbetrieb testen	Alle Funktionen des HVO's funktionieren wie geplant	erfolgreich	17.11.2016	IGZ Fabian Brandl (fbra)	
3	Test Handbetrieb (mit WinCC)	G501	3	Alle Funktionen des HVO's im Handbetrieb testen	Alle Funktionen des HVO's funktionieren wie geplant	erfolgreich	26.10.2016	IGZ Fabian Brandl (fbra)	
4	Test Handbetrieb (mit WinCC)	G501	4	Alle Funktionen des HVO's im Handbetrieb testen	Alle Funktionen des HVO's funktionieren wie geplant	erfolgreich	26.10.2016	IGZ Fabian Brandl (fbra)	
5	Test Handbetrieb (mit WinCC)	G501	5	Alle Funktionen des HVO's im Handbetrieb testen	Alle Funktionen des HVO's funktionieren wie geplant	erfolgreich	26.10.2016	IGZ Fabian Brandl (fbra)	
6	Test Handbetrieb (mit WinCC)	G501	10	Alle Funktionen des HVO's im Handbetrieb testen	Alle Funktionen des HVO's funktionieren wie geplant	erfolgreich	26.10.2016	IGZ Fabian Brandl (fbra)	
7	Test Handbetrieb (mit WinCC)	G501	11	Alle Funktionen des HVO's im Handbetrieb testen	Alle Funktionen des HVO's funktionieren wie geplant	erfolgreich	26.10.2016	IGZ Fabian Brandl (fbra)	
8	Test Handbetrieb (mit WinCC)	G501	12	Alle Funktionen des HVO's im Handbetrieb testen	Alle Funktionen des HVO's funktionieren wie geplant	offen	14.09.2016		
9	Test Handbetrieb (mit WinCC)	G501	13	Alle Funktionen des HVO's im Handbetrieb testen	Alle Funktionen des HVO's funktionieren wie geplant	fehlerhaft	26.10.2016	IGZ Fabian Brandl (fbra)	
10	Test Handbetrieb (mit WinCC)	G501	14	Alle Funktionen des HVO's im Handbetrieb testen	Alle Funktionen des HVO's funktionieren wie geplant	offen	14.09.2016		
11	Test Handbetrieb (mit WinCC)	G501	15	Alle Funktionen des HVO's im Handbetrieb testen	Alle Funktionen des HVO's funktionieren wie geplant	erfolgreich	27.10.2016	IGZ Fabian Brandl (fbra)	
12	Test Handbetrieb	G501	16	Alle Funktionen des HVO's	Alle Funktionen des HVO's funktionieren wie geplant	erfolgreich	27.10.2016	IGZ Fabian Brandl (fbra)	



Einsatzbereiche und Karrierechancen bei IGZ

IGZ Softwareentwickler | Luca Wunderlich

Luca Wunderlich



2000

Mittlere Reife
Staatl. Realschule Selb

2016

Ausbildung Fachinformatiker
EDV-Schulen Wiesau

07.2019

2018/19
Betriebspraktikum
IGZ in Falkenberg

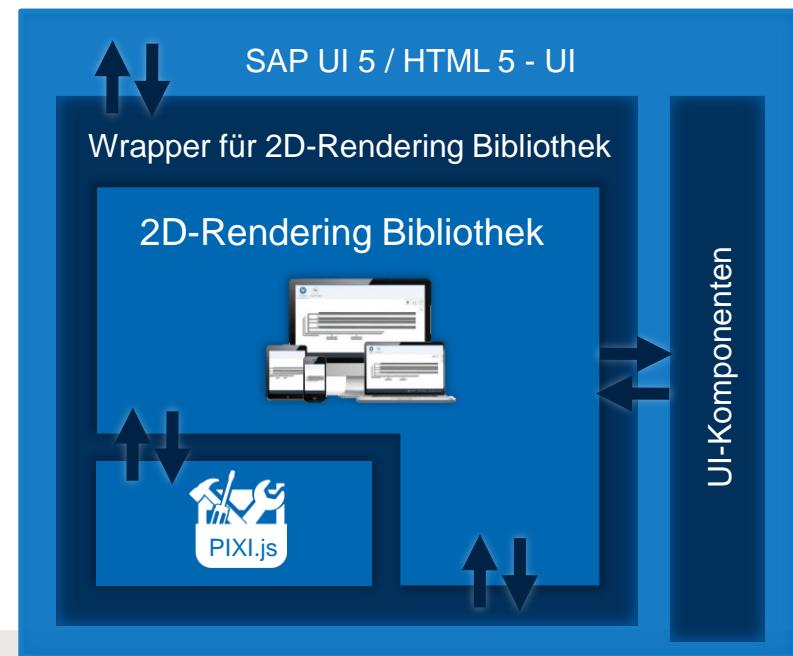
SEIT 08.2019
Softwareentwickler
IGZ in Falkenberg



Einsatzbereiche und Karrierechancen bei IGZ

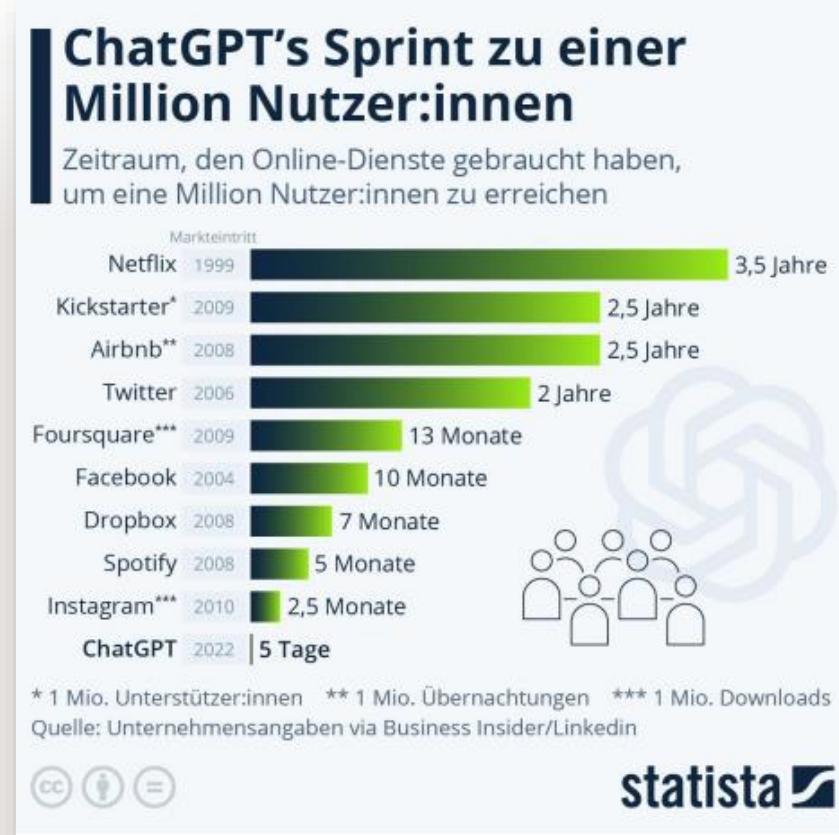
IGZ Softwareentwickler | Luca Wunderlich

□ IHK-Abschlussarbeit: Web-Bibliothek zum 2D-Rendering von Intralogistikanlagen





Hype? ChatGPT





Hype?

- Technologie entwickelt sich ständig weiter
 - Dampfmaschine
 - Auto
 - Internet / Smartphone
 - Veränderungen werden häufig unterschätzt

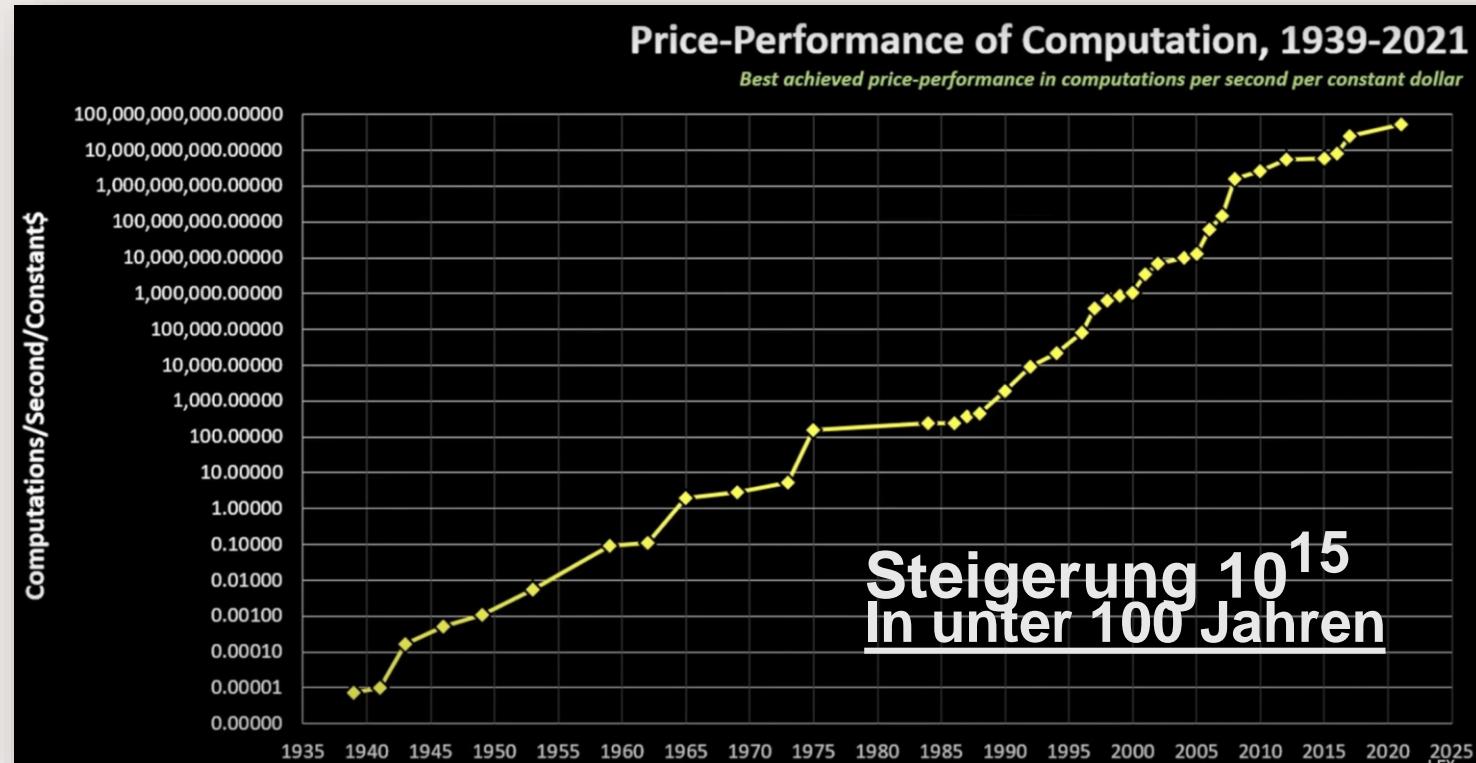
*You're crazy if you think this fool
contraption you've been wasting
your time on will ever displace the
horse*

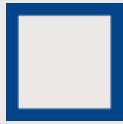




Einführung LLMs

Exponentielles Wachstum

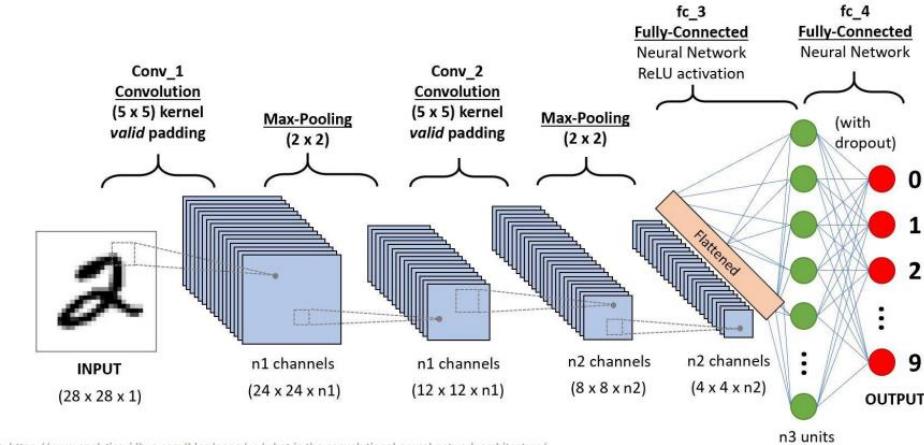
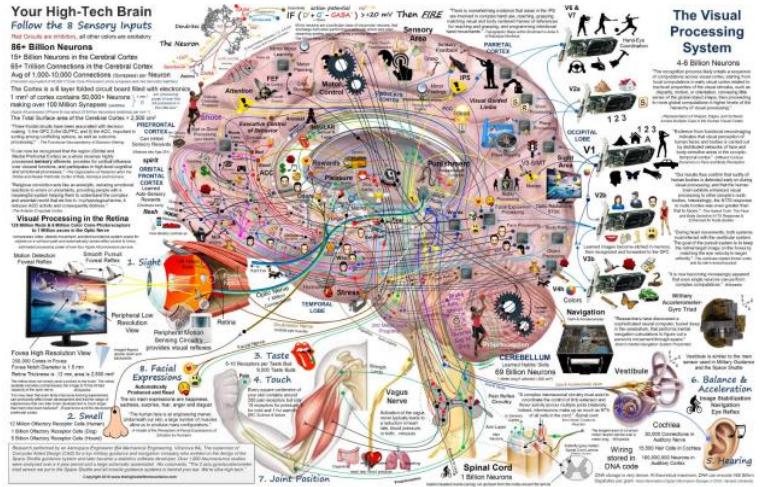




Einführung LLMs

LLM = Large Language Model

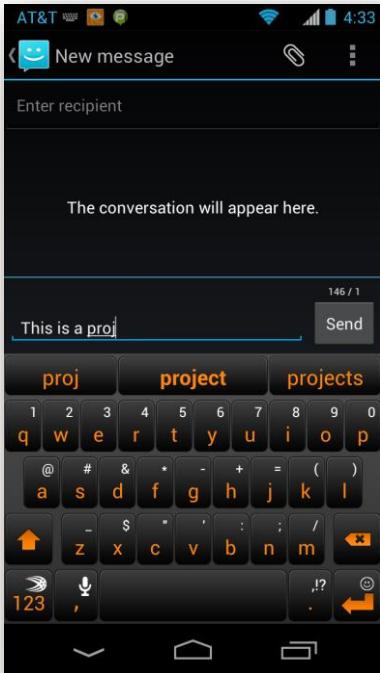
- Ähnlich wie Menschliches Gehirn, können Sachen trainiert werden
- z.B. einzelne Buchstaben zu erkennen, aber auch ganze Texte





Einführung LLMs

Next Token Prediction



generate the source code for a website containing a contact form with the following fields:
name, email, birthdate, feedback and a send button

Here is an example of the HTML source code for a website containing a contact form with the fields you specified:

```
<form action="/submit-form" method="post">
  <label for="name">Name:</label><br>
  <input type="text" id="name" name="name"><br>
  <label for="email">Email:</label><br>
  <input type="email" id="email" name="email"><br>
  <label for="birthdate">Birthdate:</label><br>
  <input type="date" id="birthdate" name="birthdate"><br>
  <label for="feedback">Feedback:</label><br>
  <textarea id="feedback" name="feedback"></textarea><br>
  <input type="submit" value="Send">
</form>
```



Einführung LLMs

Next Token Prediction

- LLMs erzeugen immer das wahrscheinlichste Folgewort
- Risiko: LLMs wissen nicht wann sie falsch liegen
- Beispiel

- Frage: Wie kann ich über die API Emails löschen?
- Trainingsdaten: **GET /me/messages/{id}**
- Keine Trainingsdaten zu Delete
- Antwort: **DELETE /me/messages/{id}**

Enter text:
One, two, three, four



Prediction

#	probs	next token ID	predicted next token
0	50.14%	11	,
1	6.66%	13	.
2	5.91%	1399	...
3	3.15%	25	:
4	2.63%	290	and
5	2.58%	986	...
6	1.42%	3926	...
7	1.17%	553	"
8	1.09%	960	-
9	1.08%	526	"



Training von LLMs

Einführung Vektordatenbanken

1. Introduction

These Terms of Service ("Terms") govern the access or use by you, an individual, from within any country in the world, of applications, websites, content, products, and services ("Services") made available by Miles of Smiles Car Rental Services, a company registered in the United States of America.

2. The Services

Miles of Smiles rents out vehicles to the end user. We reserve the right to temporarily or permanently discontinue the Services at any time and are not liable for any modification, suspension or discontinuation of the Services.

3. Bookings

- 3.1 Users may make a booking through our website or mobile application.
- 3.2 You must provide accurate, current and complete information during the reservation process. You are responsible for all charges incurred under your account.
- 3.3 All bookings are subject to vehicle availability.

4. Cancellation Policy

4.1 The last day you may cancel a reservation is 7 days prior to the start of the booking. Cancellations within the 7-day period leading up to the start of the booking period are not permitted.

5. Use of Vehicle

- 5.1 All cars rented from Miles of Smiles must not be used:
 - for any illegal purpose or in connection with any criminal offense.
 - for teaching someone to drive.
 - in any race, rally or contest.
 - while under the influence of alcohol or drugs.

→ [124, 255, 78]

→ [45, 189, 201]

→ [173, 67, 245]

→ [98, 12, 76]

→ [255, 143, 32]

Farben:





Vektordatenbank

Speichert Daten + Vektoren (im Beispiel: Farben) ab

Vektordatenbank

1. Introduction These Terms of Service ("Terms") govern the access or use by you, an individual, from within any country in the world, of applications, websites, content, products, and services ("Services") made available by Miles of Smiles Car Rental Services, a company registered in the United States of America.	→ [124, 255, 78]
2. The Services Miles of Smiles rents out vehicles to the end user. We reserve the right to temporarily or permanently discontinue the Services at any time and shall not be liable for any modification, suspension or discontinuation of the Services.	→ [45, 189, 281]
3. Bookings 3.1 Users may make a booking through our website or mobile application. 3.2 You must provide accurate, current and complete information during the reservation process. You are responsible for all charges incurred under your account. 3.3 All bookings are subject to vehicle availability.	→ [173, 67, 245]
4. Cancellation Policy 4.1 The last day you may cancel a reservation is 7 days prior to the start of the booking. Cancellations within the 7-day period leading up to the start of the booking period are not permitted.	→ [98, 12, 76]
5. Use of Vehicle 5.1 All cars rented from Miles of Smiles must not be used: - for racing purposes or in connection with any criminal offense. - for teaching someone to drive. - in any race, rally or contest. - while under the influence of alcohol or drugs.	→ [255, 143, 32]



Vektordatenbank

Abrufen von Daten

"I want to cancel my trip"



[96, 14, 73]



4. Cancellation Policy

4.1 The last day you may cancel a reservation is 7 days prior to the start of the booking. Cancellations within the 7-day period leading up to the start of the booking period are not permitted.



Stufen der AI-Hilfsbereitschaft

Zero to Hero

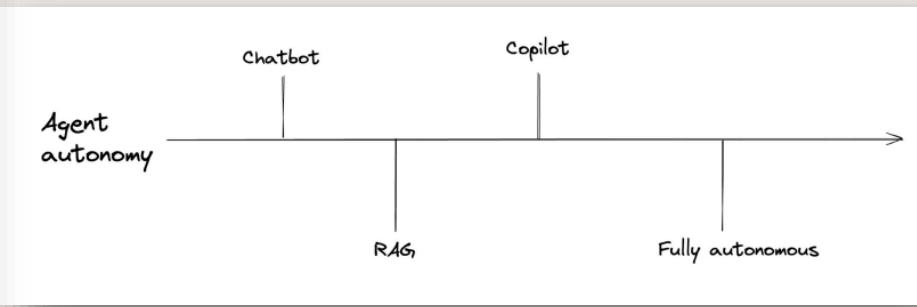


Generates a response

Generates a response based on your context

Performs tasks for you

Figures out which tasks to perform on its own





Figures out which tasks to perform on its own

IGZ FLY WITH PASSION Buchungen

Buchungsnummer	Kundenname	Flugnummer	Abflugdatum	Sitzklasse	Sitzplatz	Status
R001	John Doe	FL123	20.03.2024	Business	23A	Confirmed
R002	Jane Smith	FL456	22.03.2024	Business	7B	Confirmed
R003	Michael Johnson	FL789	25.03.2024	First	2A	Pending
R004	Emily Brown	FL321	01.04.2024	Economy	18C	Confirmed
R005	David Wilson	FL654	05.04.2024	Business	10D	Confirmed

Buchungsübersicht

Chat mit dem Support </>

Skype:
Willkommen bei IGZ Air! Mein Name ist Skye und ich bin Ihre freundliche AI-Assistentin. Wie kann ich Ihnen heute helfen?

Sie:
Hi Skye, kannst du John Doe in die Business Class upgraden?

Skype:
Ich habe die Änderung erfolgreich durchgeführt. John Doe wurde auf die

Nachricht eingeben... **Senden**

GPT Chat

Dev Console

Ausgeführte Datenbank Befehle

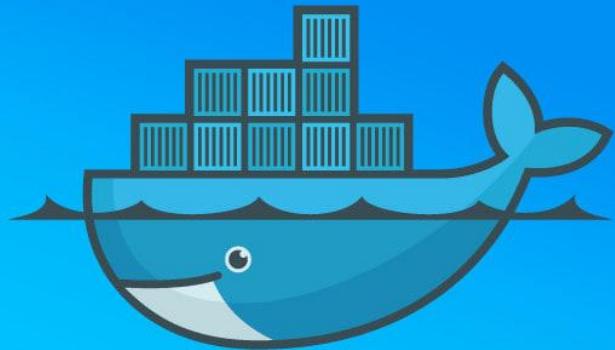
Skye called her AI Plugin, retrieving all reservations from the MongoDB database.

Skye called her AI Plugin, executing MongoDB query: { 'update': 'Reservations', 'updates': [{ 'q': { '_id': 'R001' }, 'u': { '\$set': { 'SeatClass': 'Business' } } }] }



Einführung Docker

Kapitel 1



docker



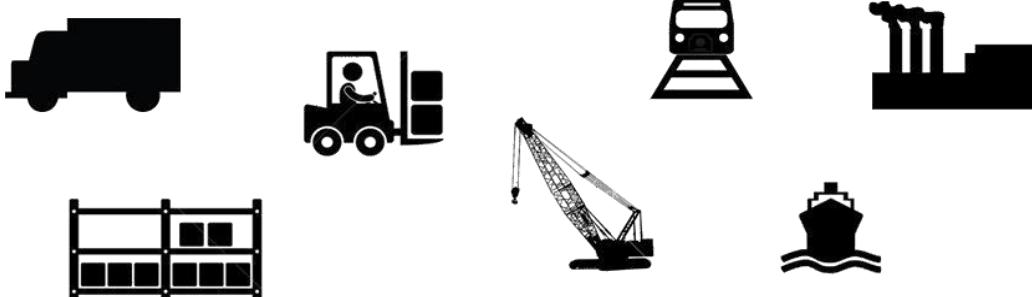
Logistik Probleme vor 50 Jahren..

Verschiedene Waren-/Transportgruppen

Viele Warengruppen:



Viele verschiedene
Transportverfahren:





Vergleich Logistik

Matrix-Problem

	?	?	?	?	?	?	?
	?	?	?	?	?	?	?
	?	?	?	?	?	?	?
	?	?	?	?	?	?	?
	?	?	?	?	?	?	?
	?	?	?	?	?	?	?



Die Lösung: Container Standardisierung

Lösung:
Container



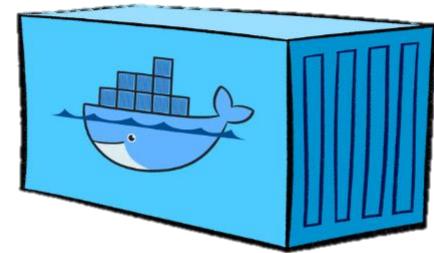


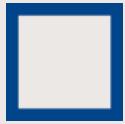
Vergleich Anwendungen

Matrix-Problem

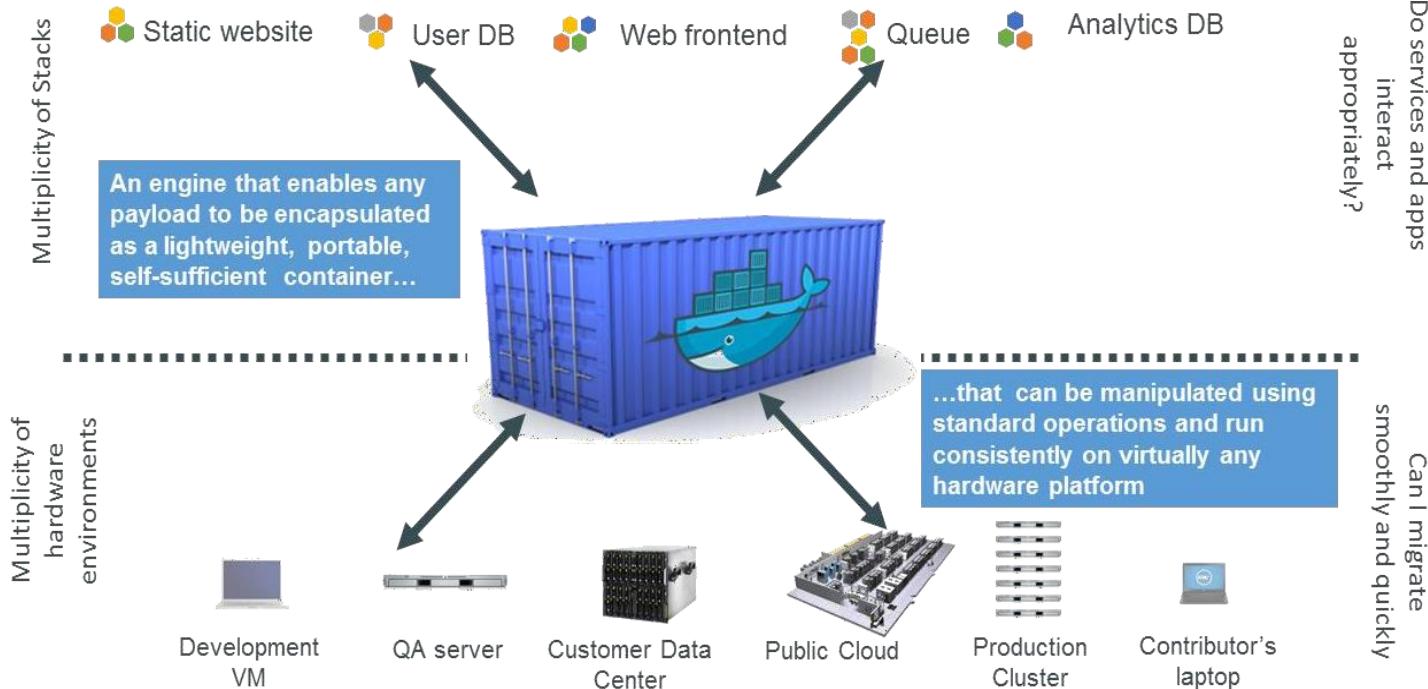
	Static website	?	?	?	?	?	?	?
	Web frontend	?	?	?	?	?	?	?
	Background workers	?	?	?	?	?	?	?
	User DB	?	?	?	?	?	?	?
	Analytics DB	?	?	?	?	?	?	?
	Queue	?	?	?	?	?	?	?
	Development VM	QA Server	Single Prod Server	Onsite Cluster	Public Cloud	Contributor's laptop	Customer Servers	

Lösung:
Container



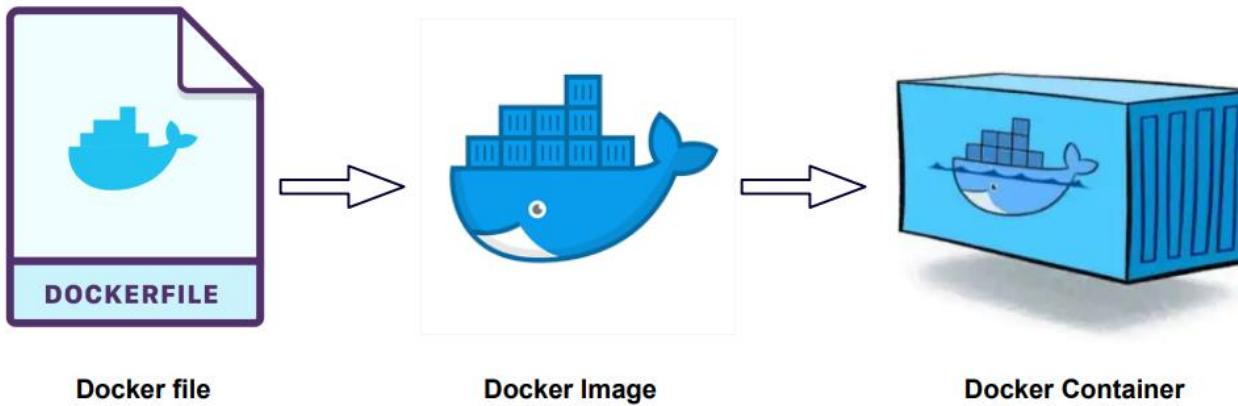


Container für Code (=Anwendungen)



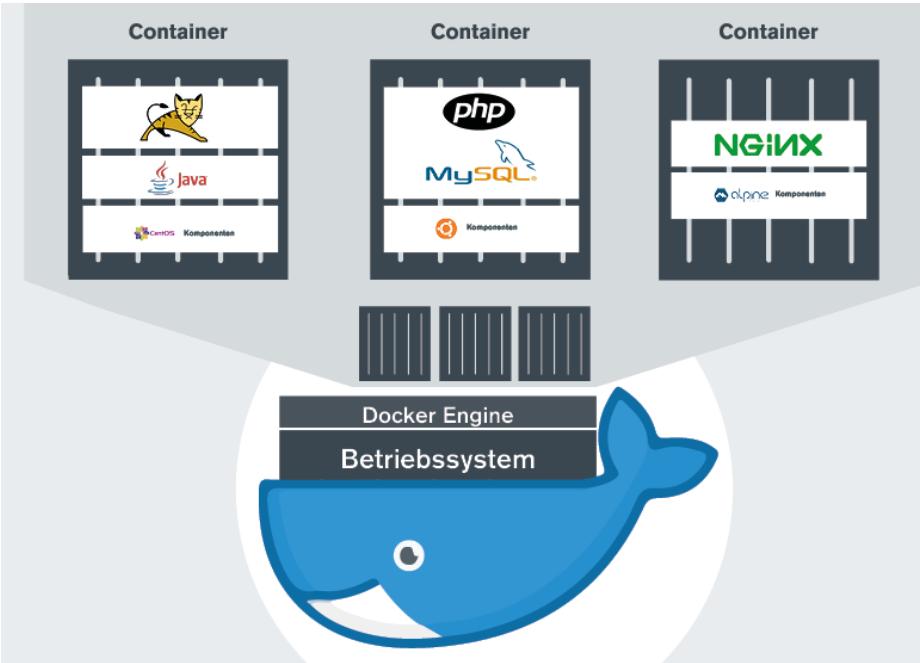


Docker Container erstellen ...





Docker Engine kann mehrere Container laufen lassen ...

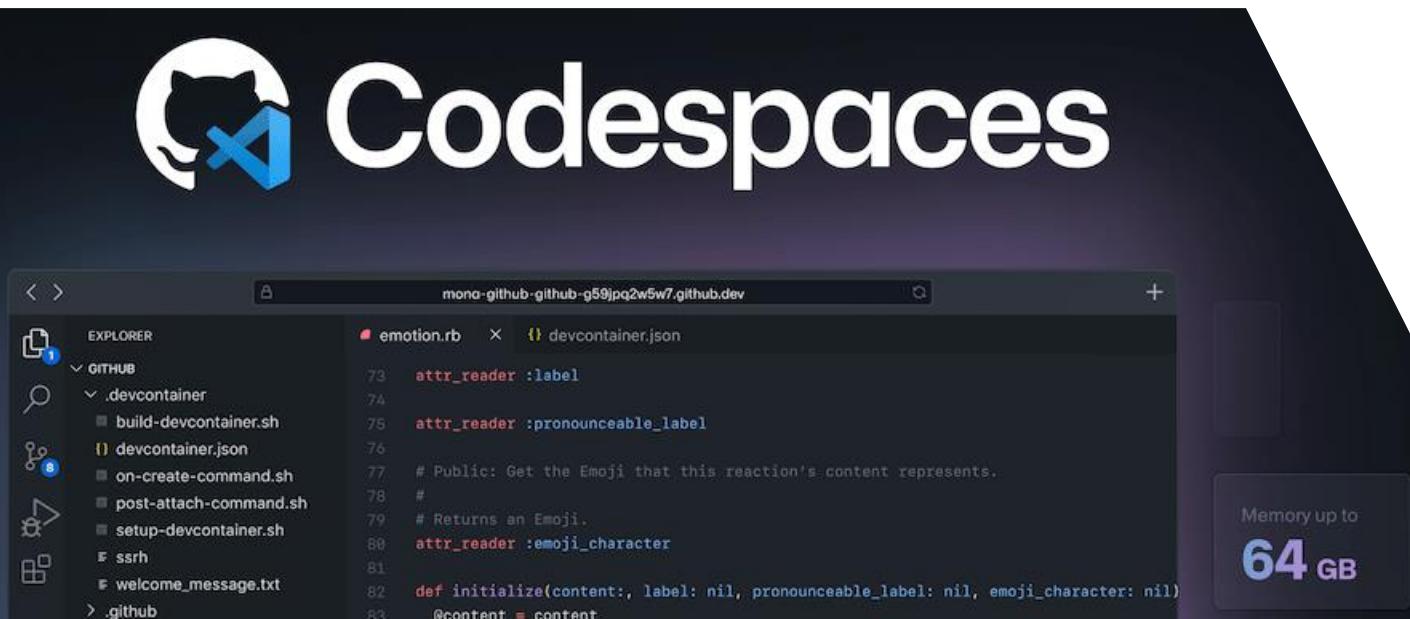




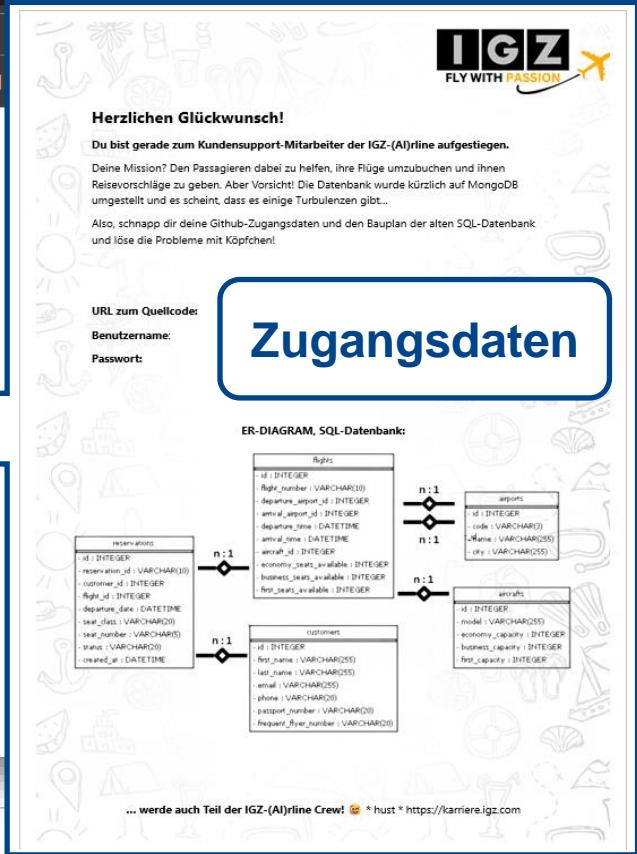
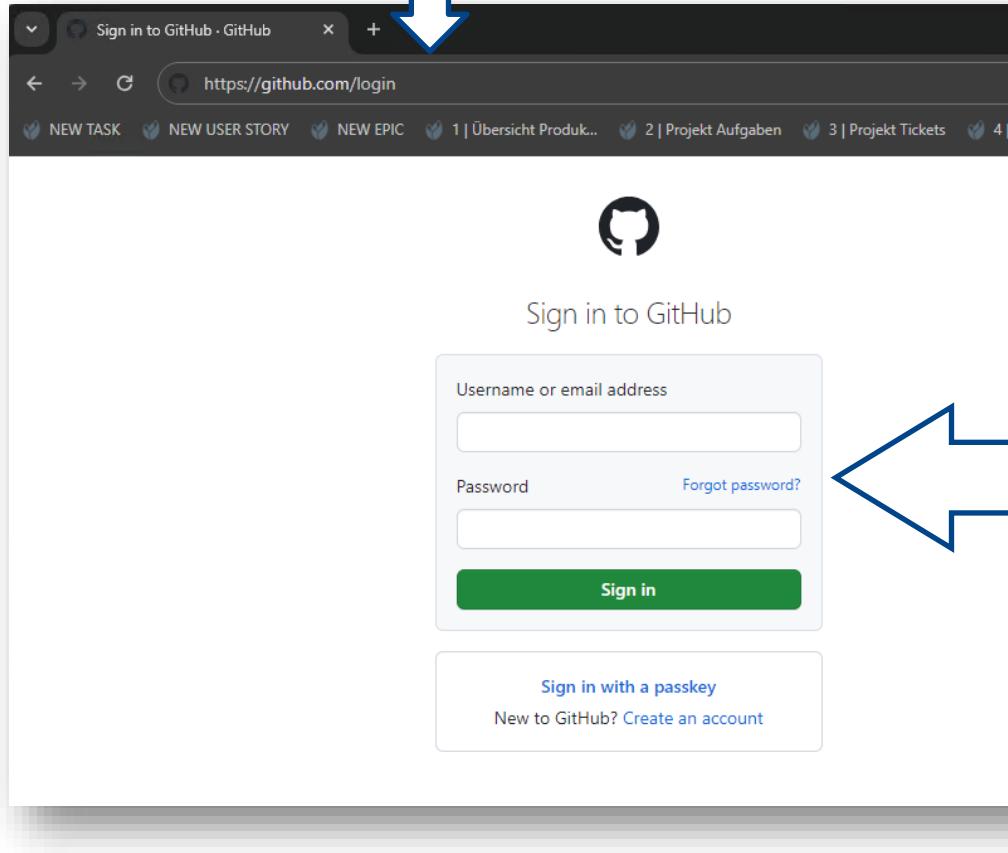
Codespace

von GitHub

- Vollständige, konfigurierbare Entwicklungsumgebung in der Cloud
- Direkte Bearbeitung, Ausführung und Debugging von Code innerhalb von GitHub, ohne dass lokale Entwicklungswerkzeuge erforderlich sind.



<https://github.com/login>



Authentication Code Retrieval

Account Name	Authentication Code	Timestamp
ITCampusStudent1	719447	14.3.2024, 20:25:58

<https://tinyurl.com/gitigz>



<https://github.com/IGZ-ICC-PROD/IGZAir>

The screenshot shows a GitHub repository page for 'IGZAir'. The URL in the browser's address bar is highlighted with a blue box and an arrow pointing to it. The repository name 'IGZAir' is also highlighted with a blue box and an arrow pointing to it. The repository is private, as indicated by the 'Private' badge. The main navigation tabs are 'Code', 'Issues', 'Pull requests', 'Actions', 'Projects', 'Security', 'Insights', and 'Settings'. Below the tabs, there are buttons for 'Edit Pins', 'Watch 0', 'Fork 0', 'Star 0', and a dropdown menu. On the left, there is a sidebar with files like '.devcontainer', 'CustomerRequestServer', '.dockerignore', '.gitignore', 'NoSQLGPT.sln', and 'README'. The main content area shows a 'Local' tab selected and a 'Codespaces' tab. Under 'Codespaces', it says 'No codespaces' and 'You don't have any codespaces with this repository checked out'. There is a prominent green 'Create codespace on main' button. A large blue callout box with the text 'Erstellen des Codespaces' is overlaid on the right side of the main content area. At the bottom, it says 'Codespace usage for this repository is paid for by IGZfbrandl.' Logos for IGZ and SAP are at the bottom.

GitHub will provide users in the Free plan 120 core hours, or 60 hours of run time on a 2 core codespace, plus 15 GB of storage each month. You can see how the remaining balance on the billing page.



Willkommen - NoSQLGPT [CodeSpace]

curlly-tribble-x555x97vj9p5hv45v.github.dev

NEW TASK NEW USER STORY NEW EPIC 1 Übersicht Produkte 2 Projekt Aufgaben 3 Projekt Tickets 4 Grobplanung (E... 6 Aufgabenplanung

Watch 1 Fork 0 Star 0

Go to file Add file Code Local Codespaces Codespaces About No description, website, or topics provided. Activity 0 stars 1 watching 0 forks

Codespaces Your workspaces in the cloud + ...

On current branch curly tribble main Active ...

Codespace usage for this repository is paid for by lwu-igz.

Standardmäßig auf auto-delete ✓

Rename Export changes to a branch Change machine type Stop codespace Auto-delete codespace Open in Browser Open in Visual Studio Code Open in JetBrains Gateway Beta Open in JupyterLab Beta Delete

EXPLORER NOSQLGPT [CODESPACES: CURLY TRIBBLE] CustomerRequestServer Controllers Domain Hubs Infrastructure

Start Neue Datei... Datei öffnen... Git-Repository klonen...

Exemplarische Vorgehensweisen Erste Schritte mit VS Co... Passen Sie Ihren Editor an, lernen Sie die Grundlagen

1. In richtiges Verzeichnis wechseln:

```
@lwu-igz → /workspaces/NoSQLGPT (main) $ cd CustomerRequestServer/
```

2. Docker Container starten:

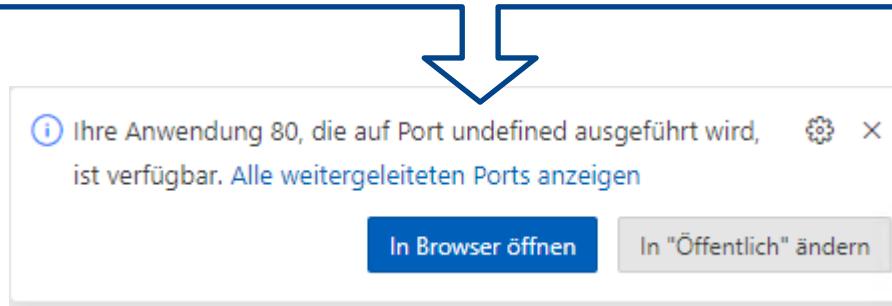
```
@lwu-igz → /workspaces/NoSQLGPT/CustomerRequestServer (main) $ docker compose up
[+] Running 18/10
  ✓ db 8 layers [██████████]    0B/0B    Pulled
  ✓ mongo-express 8 layers [██████████] 0B/0B    Pulled
```

t + P or F1). Edit away, run as usual, and we'll automatically make it available for you to access.

```
@lwu-igz → /workspaces/NoSQLGPT (main) $ cd CustomerRequestServer/
@lwu-igz → /workspaces/NoSQLGPT/CustomerRequestServer (main) $ docker compose up
[+] Running 0/2
  : db Pulling
  : mongo-express Pulling
```

Layout: German 1.8s 1.8s

Öffnet Anwendung in einem neuen TAB;
der Link ist Privat, funktioniert
nur in Verbindung mit GitHub-Account





Einführung Cloud Native

Kapitel 3





Evolution der Softwareentwicklung

Wie kann ich davon profitieren?

Klassisch

Code

Infrastruktur

Framework

Code

Infrastruktur

Container

Code

Infrastruktur

Cloud Native

Low Code

Infrastruktur

Aufwand

Fertige Komponenten übernehmen mehr Aufgaben



Wir leben in der Steinzeit...



Nutzt die richtigen Werkzeuge...



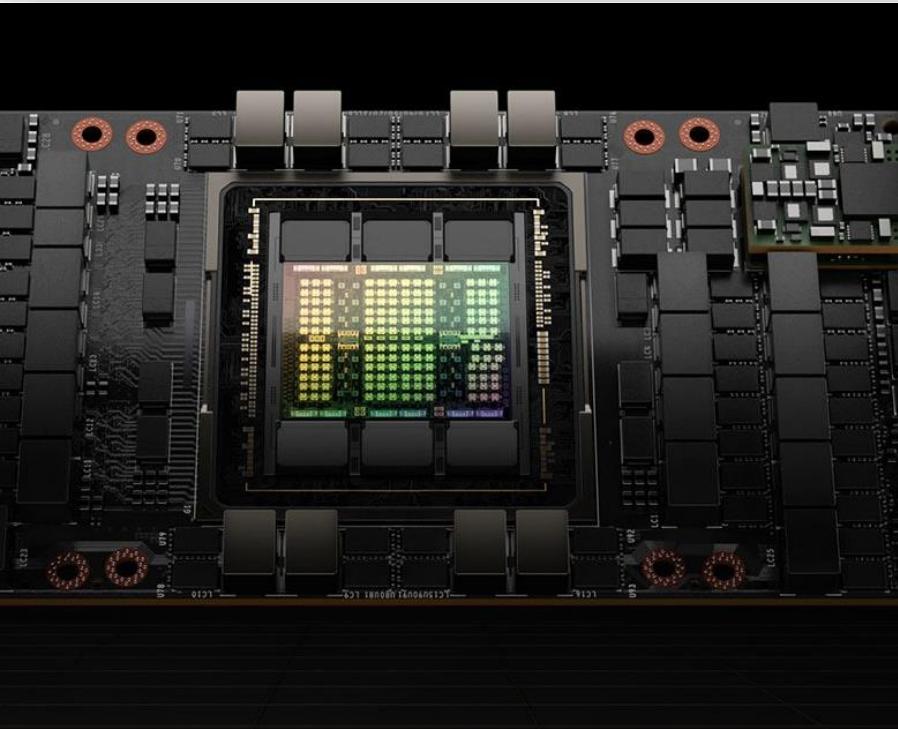


Einführung LLMs / OpenAI / GPTs

AI = CloudOnly

- Modelle müssen erstmal trainiert werden damit sie ausgeführt werden
 - Bei ChatGPT 4 (turbo)
 - TB an Daten
 - > 1000 GPUS
 - Danach können diese ausgeführt werden
 - Ausführungspower bei ChatGPT 4 (turbo)

= Deswegen Cloud Only, Clouddienste bei AI nutzen!





Einführung MongoDB / NoSQL-DB

Kapitel 2



MongoDB.®

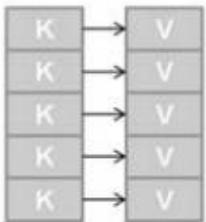




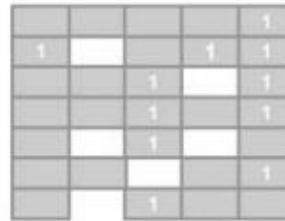
NoSQL-Datenbanken im Überblick

Datenstrukturen im Überblick

Key-Value Stores



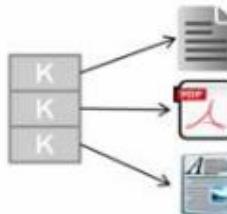
Column Stores



Graph Databases



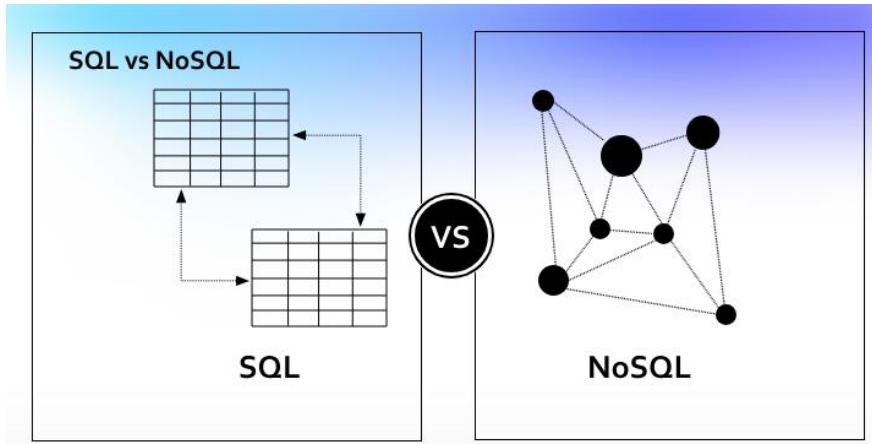
Document Stores





Einführung / Vor-/Nachteile

- NoSQL soll keinen Boykott relationaler Datenbanksysteme aufrufen
- not only SQL, wobei SQL als Synonym für relationale Datenbankensysteme



Not
Only

~~NoSQL~~
Relational



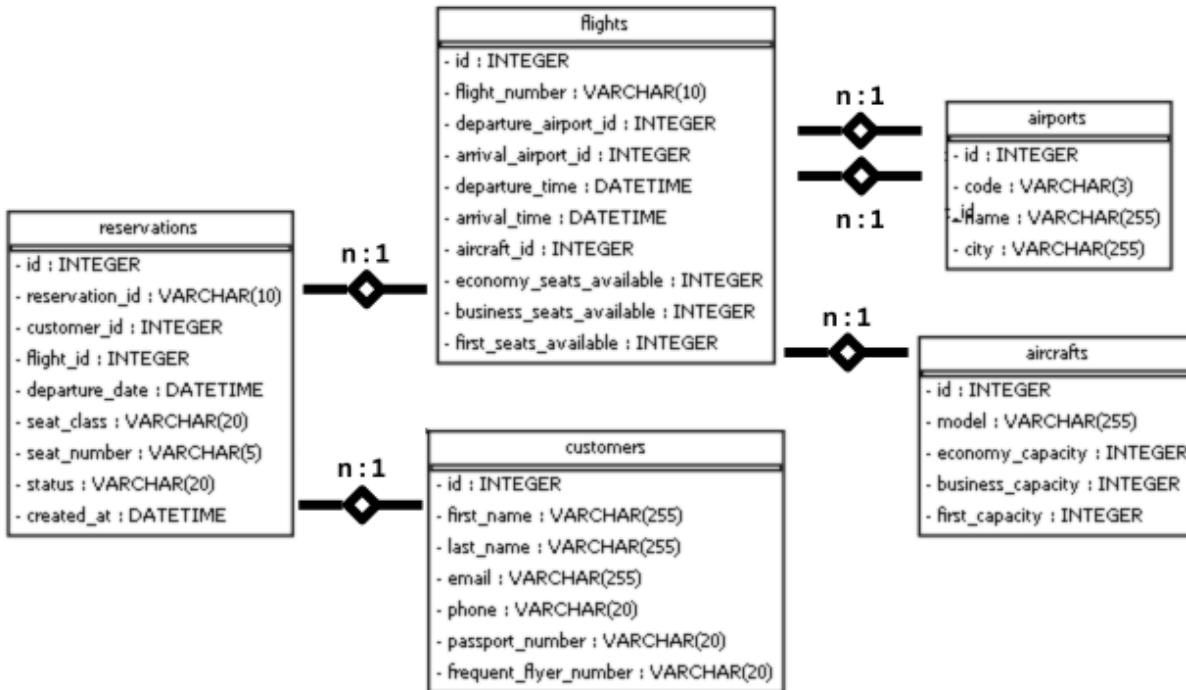
Buchungen

Buchungsnummer	Kundenname	Flugnummer	Abflugdatum	Sitzklasse	Sitzplatz	Status
R001	John Doe	FL123	20.03.2024	Business	23A	Confirmed
R002	Jane Smith	FL456	22.03.2024	Business	7B	Confirmed
R003	Michael Johnson	FL789	25.03.2024	First	2A	Pending
R004	Emily Brown	FL321	01.04.2024	Economy	18C	Confirmed
R005	David Wilson	FL654	05.04.2024	Business	10D	Confirmed



Umsetzung in SQL

ER-Diagram: normalisiert u. strukturiert





SQL vs. MongoDB

Schema-Design: Dokumenten Gedanke



Tabelle Flights :

- FlightNumber (string, PRIMARY KEY)
- DepartureTime (datetime)
- ArrivalTime (datetime)
- Origin (string)
- Destination (string)
- Aircraft (string)



1 : 1 Verbindung

Tabelle SeatsAvailable :

- FlightNumber (string, FOREIGN KEY, verweist auf Flights.FlightNumber)
- Economy (int)
- Business (int)
- First (int)



mongoDB

Sammlung Flights :

- _id (ObjectId, automatisch generiert)
- FlightNumber (string)
- DepartureTime (Date)
- ArrivalTime (Date)
- Origin (string)
- Destination (string)
- Aircraft (string)
- SeatsAvailable (Unterdokument)
 - Economy (int)
 - Business (int)
 - First (int)

Unterdokument





Umsetzung in MongoDB

Dokument-Collections: direkte JSON u. unstrukturiert

Flights

```
"_id": "FL123",
"DepartureAirport": {
  "Code": "JFK",
  "Name": "John F. Kennedy International Airport",
  "City": "New York"
},
"ArrivalAirport": {
  "Code": "LHR",
  "Name": "London Heathrow Airport",
  "City": "London"
},
"DepartureTime": "2024-03-20T09:00:00Z",
"ArrivalTime": "2024-03-20T12:30:00Z",
"Aircraft": {
  "Model": "Boeing 747",
  "Capacity": {
    "Economy": 100,
    "Business": 20,
    "First": 10
  }
},
"SeatsAvailable": {
  "Economy": 80,
  "Business": 15,
  "First": 8
}
```

Reservations

```
_id: 'R001',
Customer: {
  FirstName: 'John',
  LastName: 'Doe',
  Email: 'john.doe@example.com',
  Phone: '+1-123-456-7890',
  PassportNumber: 'ABC123456',
  FrequentFlyerNumber: 'FF1234'
},
FlightNumber: 'FL123',
DepartureDate: ISODate('2024-03-20T00:00:00.000Z'),
SeatClass: 'Economy',
SeatNumber: '123A',
Status: 'Confirmed',
CreatedAt: ISODate('2024-02-15T10:30:00.000Z')
```

Zugriff auf MongoExpress (Admin-UI von Mongo) via. Port 8081

The screenshot shows a web browser window with the following details:

- Address Bar:** The URL is <https://redesigned-fiesta-5ggg54jxwgw524p64-8081.app.github.dev>.
- Content Area:** A modal dialog titled "Anmelden" (Login) is displayed. It contains a form with two fields:
 - Nutzername:** admin
 - Passwort:**
- Annotations:** Two blue arrows point from the text "Benutzer: admin" and "Passwort: pass" to their respective input fields in the modal.

The screenshot shows the Mongo Express interface. On the left, under the heading 'Mongo Express Database', there is a list of databases:

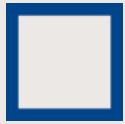
- AirIGZ
- admin
- config
- local

A dashed blue arrow points from the 'AirIGZ' database entry to the right-hand panel, which displays the contents of the 'AirIGZ' database.

The right-hand panel has a header 'Database Name' with a '+ Create Database' button. Below it, the URL is shown as 'redesigned-fiesta-5ggg54jxwgw524p64-8081.app.github.dev/db/AirIGZ/'. The title of this panel is 'Mongo Express Database: AirIGZ'. The main content area is titled 'Viewing Database: AirIGZ' and contains a 'Collections' section:

Collection Name	+ Create collection
Flights	
Reservations	

Each collection row includes a 'View' button (green), an 'Export' button (orange), a '[JSON]' button (orange), and an 'Import' button (orange).



MongoDB vs. SQL

CRUD-Operationen

□ Ähnlich zu SQL gibt es in MongoDB Befehle für das ...

- Einfügen (Create)
- Lesen (Read)
- Aktualisieren (Update)
- Löschen (Delete)



... von Datensätzen

Flights - Mongo Express

redesigned-fiesta-5ggg54jxwgv524p64-8081.app.github.dev/db/AirIGZ/Flights

NEW TASK NEW USER STORY NEW EPIC 1 | Übersicht Produkt... 2 | Projekt Aufgaben 3 | Projekt Tickets 4 | Grobplanung (E... 5 | Feinplanung (U... Alle Lesezeichen

Mongo Express Database: AirIGZ Collection: Flights

* Klick *

New Document New Index

Simple Advanced

Key Value String Find

Delete all 5 documents retrieved

Viewing Collection: Flights

New Document New Index

Simple Advanced

Query Projection Aggregate query

Find

Delete all 5 documents retrieved

Mongo DB-Query
! Hinweis: Syntax ist hier
„MongoExpress“; wir nutzen
in nächsten Folien eine andere
Syntax für Übungen ...



MongoDB vs. SQL

Einfügen (Create)



```
<SQL>

CREATE TABLE Flights (
    FlightNumber VARCHAR(255),
    DepartureTime DATETIME,
    ArrivalTime DATETIME,
    Origin VARCHAR(255),
    Destination VARCHAR(255),
    Aircraft VARCHAR(255),
    Economy INT,
    Business INT,
    First INT,
    PRIMARY KEY (FlightNumber)
);
```



```
{"createCollection": "flights"}
```





MongoDB vs. SQL

Einfügen (Create)



<SQL>

```
INSERT INTO Flights VALUES ('FL123', '2024-03-20 09:00:00', '2024-03-20 12:30:00', 'JFK', 'LHR', 'Boeing 747', 100, 20, 10);
```



```
{
  "insert": "Flights",
  "documents": [
    {
      "FlightNumber": "FL987",
      "DepartureAirport": {
        "Code": "SFO",
        ...
      },
      "ArrivalAirport": {
        "Code": "JFK",
        ...
      }
    }
  ]
}
```



MongoDB vs. SQL

Lesen (Read)



<SQL>

```
SELECT * FROM Flights WHERE FlightNumber = 'FL123';
```



```
{ "find": "Flights", "filter": { "_id": "FL123" } }
```





MongoDB vs. SQL

Aktualisieren (Update)



<SQL>

```
UPDATE Flights SET Aircraft = 'New Aircraft' WHERE FlightNumber = 'FL123';
```



```
{ "update": "Flights", "updates": [ { "q": { "_id": "FL123" }, "u": { "$set": { "Aircraft.Model": "Airbus A380" } } } ] }
```



MongoDB vs. SQL

Löschen (Delete)



<SQL>

```
DELETE FROM Flights WHERE FlightNumber = 'FL123';
```



```
{
  "delete": "Flights",
  "deletes": [
    {
      "q": {
        "_id": "FL123"
      },
      "limit": 1
    }
  ]
}
```



mongoDB

<https://www.mongodb.com/docs/manual>

The screenshot shows a browser window displaying the MongoDB Documentation website at <https://www.mongodb.com/docs/manual/introduction/>. A blue arrow points from the URL bar at the top left down to the browser's address bar.

The page title is "Introduction to MongoDB". The navigation bar includes links for NEW TASK, NEW USER STORY, NEW EPIC, Übersicht Produkt., Projekt Aufgaben, Projekt Tickets, Grobplanung (E...), Feinplanung (U...), Alle Lesezeichen, Products, Resources, Solutions, Company, Pricing, Support, Sign In, and a green "Try Free" button.

The left sidebar is titled "MongoDB Documentation" and contains a dropdown menu set to "7.0 (current)". It lists sections under "MongoDB Manual": Introduction, Getting Started, Create an Atlas Free Tier Cluster, Databases and Collections, Documents, MongoDB Query API, BSON Types, Installation, MongoDB Shell (mongosh), and MongoDB CRUD Operations. The "Introduction" section is currently selected.

The main content area shows the "Introduction to MongoDB" page. The breadcrumb navigation is "Docs Home → Develop Applications → MongoDB Manual". The page content includes:

- You can create a MongoDB database in the following environments:
 - MongoDB Atlas: The fully managed service for MongoDB deployments in the cloud
 - MongoDB Enterprise: The subscription-based, self-managed version of MongoDB
 - MongoDB Community: The source-available, free-to-use, and self-managed version of MongoDB

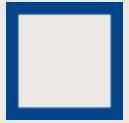
To learn more about creating a MongoDB database with the Atlas UI, see [Get Started with Atlas](#).

Document Database

A record in MongoDB is a document, which is a data structure composed of field and value pairs. MongoDB documents are similar to JSON objects. The values of fields may include other documents, arrays, and arrays of documents.

name: "sue",
age: 26,

← field: value
← field: value



- 1. Aufgabe:** Rufe die Flugdetails (Flugnummer, Abflugflughafencode und Ankunftsflughafencode) für Flüge ab, die nach 21.03.2024 abfliegen
- 2. Aufgabe:** Berechne die Gesamtzahl der verfügbaren Sitze (Economy, Business und First Class) für jeden Flug. Gib die Flugnummer und die Gesamtzahl der verfügbaren Sitze im Ergebnis aus.
- 3. Aufgabe:** Die Fluggesellschaft hat beschlossen, alle Flüge mit Boeing-Flugzeugen aufgrund von Sicherheitsbedenken zu stornieren. Schreibe eine Update-Abfrage, um die verfügbaren Sitze für alle Klassen auf Flügen mit Boeing-Flugzeugen auf 0 zu setzen.

The screenshot shows a GitHub repository page for 'IGZfbrandl/NoSQLGPT'. The repository has 1 branch and 0 tags. A warning message in the top right corner states: 'Servicehinweis! No description, topics provided by owner'. A yellow warning triangle icon is overlaid on the message. A context menu is open over a 'redesigned fiesta' codespace, listing options: Rename, Export changes to a branch, Change machine type, Stop codespace, Auto-delete codespace (selected), Open in Browser, Open in Visual Studio Code, Open in JetBrains Gateway (Beta), and Open in JupyterLab. Arrows point from three text boxes to specific menu items: 'Stoppt Codespace' points to 'Stop codespace', 'oder' points to 'Auto-delete codespace', and 'Löscht Codespace' points to 'Delete'.

Servicehinweis!

Stoppt Codespace

oder

Löscht Codespace

Vielen Dank!

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Iringklinger | Endi
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hemosan | Hum
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boehringer Ingelh
MANN | FESTO |
umana | KRAFT
SFS services | SII
igelheim | backal
ESTO | fischer |
ERMI | Hans Kup
SIEMENS HDP | S
ackaldrin | BASF
EBERIT | GERO
upfer & Sohn | KC
tesa | Tarkett |
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| Wirtgen Group | Winthrop | WALA | ZF TRAF
Post | DHL | DB SCHENKER | Dr. Oetker |
GO BOSS | Hoffm
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A | ZF TRADING |
Dr. Oetker | esco |
Offmann Group | Hr
Prym | Red Bull | F
RADING | AL-KO |
Oetker | esco | elrir
mann Group | Har
Bull | RITTAL | syr
| AL-KO | apetito |
ker | erlingklinger | Endress+Hauser | ESSMANN |
up | Hansgrohe | Herba Chemosan | Humana | KRA
ITTAI | symrise | Sika | sanofi aventis | SFS services |
tito | Bayer Health Care | Boehringer Ingelheim | backal